





Resolved: The United States ought to adopt carbon pricing.

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TOPIC ANALYSIS

This topic asks debaters to analyze a timely question of the pertinence, potential benefits and potential detriments of Carbon Pricing. The topic is especially important given the increasing danger of climate change to the survival of the human race as well as the earth itself. The fear and certainty of climate change have both increased dramatically in recent years, some even pointing to the inevitability of a 'sixth mass extinction'. In this context, even the most profit minded businesses are realizing the importance of addressing climate change. Thus, the status quo corporate inaction and lack of staunch, universal policy has largely come into question. The particulars in the debate over Carbon Pricing, as well as the environmental needs that led to the necessity of regulations concerning energy production and use can be found in the further readings section of this file.

Affirmative debaters on this topic will be able to access ground in several ways. First, the dangers of business' environmental apathy, that have been proven to be very real by thousands of researchers and scientists, will be used by AFF debaters to illustrate the outdated and unsafe practices of corporations within the United States. Second, AFF debaters will be able to access links to several economic benefits of carbon pricing that would potentially pass on the earnings from Carbon Pricing directly to the populous, as well as the efficiency inherent in Carbon Pricing as compared to status quo policies or similar options. Additionally, affirmative cases will be able to isolate some very real "harms" to the environment that could be solved relatively quickly with an effective carbon pricing regime.

Negative debaters on this topic will be able to debate from a handful of solid areas of argumentative ground. First, the very real infeasibility of past forms of carbon reduction policies can be used to illustrate the potential ineffectiveness of a future universal carbon pricing regime. While this seems defensive at best, there have been very real harms from current cap-and-trade policies as well as several instances of blatantly ineffective enforcement systems leading to worse pollution. Second, if only the United States were to implement Carbon Pricing, the lack of a clear universal standard across countries would simply create pollution havens where companies would flee the US's more restrictive laws. This could effectively increase the amount of pollution as countries fall prey to corporate influence in their environmental policymaking efforts. Unfortunately, in an increasingly polluted world, the point of no return is quickly approaching, fixing the issue of climate change could potentially have already passed the point of feasibility.

Additionally, there is some debate to be had on both sides of this topic stemming from the specification of "Carbon Pricing" as some forms of carbon reduction policy such as cap-and-trade and direct carbon taxation could potentially fall in and out of that category allowing for a variety of ways to approach the topic for both AFF and NEG.

Finally, interesting critical ground exists across this topic. Many thinkers have criticized the way we as humans have engaged with the environment as if it were a standing reserve of resources that exist to be dominated and controlled by humankind. Along these same lines, debaters interested in critiquing anthropocentrism and concepts of state apparatuses engaging with the environment will find ample resources criticizing the environmentally destructive empires set up by world powers like the US, China, and more. Finally, the question of the degree to which environmental concerns intermingles with capitalism at the heart of this topic opens up linkages to a wide variety of critical thinkers.



Further Reading

1. "Carbon Pricing, Growth and the Environment" by Lawrence A. Kreiser, 2012
2. "Carbon Pricing: Early Experience and Future Prospects" by John Quiggin, David Adamson, Daniel Quiggin, 2014
3. "Climate Policy after Copenhagen: The Role of Carbon Pricing" by Karsten Neuhoff, 2011
4. "Pricing Carbon: The European Union Emissions Trading Scheme" By A. Denny Ellerman, Frank J. Convery, Christian de Perthuis
5. "State and Trends of Carbon Pricing 2014" - Report by World Bank, 2014
6. "How Much Carbon Pricing is in Countries' Own Interests? The Critical Role of Co-Benefits" Ian W.H. Parry, Mr. Chandara Veung, Mr. Dirk Heine of the IMF, 2014
7. <http://www.theguardian.com/environment/2012/jul/16/carbon-price-tax-cap>
8. <http://www.climatecentral.org/news/oil-companies-carbon-price-19054>
9. <http://www.brookings.edu/blogs/planetpolicy/posts/2015/07/13-carbon-footprint-gouvernement-shadow-prive-morris>



1AC

I affirm, Resolved: The United States ought to adopt carbon pricing.

Since the word “ought” in the resolution implies a moral obligation the best value for this debate is Morality (def. of ought from Merriam Webster: <http://www.merriam-webster.com/dictionary/ought>)

Foremost among moral obligations is protecting the environment, according to Kucinich in 94:

John Kucinich, Judge Advocate specializing in environmental law, ENVIRONMENTAL LAW REVIEW, Spring 1994, p. 501.

Finally, and least pragmatic, is the moral duty not to exterminate our fellow passengers on this planet. With its origins at least as ancient as the biblical injunction to “replenish” the earth as its caretakers, this moral duty has strong precedential support. Although most people accept the propriety of human use of other species, they would draw the line at exploiting these species into extinction. Thus moral duty may be seen as an obligation to refrain from “murdering” another species, because that species has in some sense a right to exist. Additionally, people may want to preserve other species as a living legacy for their children and grandchildren, feeling it is wrong to deprive their posterity of a heritage their own ancestors had passed down for their enjoyment.

Thus, the best standard to achieve Morality is the Precautionary Principle, According to Smith in 2K:

(From “The Precautionary Principle and Environmental Policy Science, Uncertainty, and Sustainability” available online at: <http://www.sehn.org/pdf/ppep.pdf>)

In the context of chemicals, the precautionary principle or approach responds to the complexity of environmental health problems, the paucity of information and subsequent uncertainty about cause effect relations, and the slow pace of government testing and government decision making. At its core, the principle calls for preventive, anticipatory measures to be taken when an activity raises threats of harm to the environment, wildlife, or human health, even if some cause-and-effect relationships are not fully established. The precautionary approach is a logical extension of commonsense concepts that guide daily life: “an ounce of prevention is worth a pound of cure”; “better safe than sorry”; the Hippocratic Oath’s “first, do no harm.” It challenges us to prevent harm before it occurs. It holds that when there is scientific evidence that an activity threatens wildlife, the environment, or human health, protective measures should be taken even in the absence of full scientific certainty. The inclusion of this concept in the Rio Declaration on Environment and Development placed precaution on the global stage. Issued in 1992 by the United Nations Conference on Environment and Development (the “Earth Summit”), the Declaration enumerated Precaution as one of 27 principles to guide environmental and development policies:



Contention 1: Carbon Pricing is the best way to fix the environment.

Power generation causes CO₂ pollution and greenhouse emissions

UK Parliament, 2006

[October 2006 Number 268 <http://www.parliament.uk/documents/upload/postpn268.pdf>. "Carbon footprint of electricity generation"

download date: 6-9-08]

All electricity generation technologies generate carbon dioxide (CO₂) and other greenhouse gas emissions. To compare the impacts of these different technologies accurately, the total CO₂ amounts emitted throughout a system's life must be calculated. Emissions can be both direct - arising during operation of the power plant, and indirect - arising during other non-operational phases of the life cycle. Fossil fuelled technologies (coal, oil, gas) have the largest carbon footprints, because they burn these fuels during operation. Non-fossil fuel based technologies such as wind, photovoltaics (solar), hydro, biomass, wave/tidal and nuclear are often referred to as 'low carbon' or 'carbon neutral' because they do not emit CO₂ during their operation. However, they are not 'carbon free' forms of generation since CO₂ emissions do arise in other phases of their life cycle such as during extraction, construction, maintenance and decommissioning (Fig 1).

Failure to act now means that Global Warming will continue. This will cause a massive release of oceanic methane, and a rapid warming. The end result would be the end of life on Earth.

Edwards and Cromwell 2005

['Silence Is Green The Green Movement And The Corporate Mass Media by David Edwards and David Cromwell, February 9, <http://www.zmag.org/content/showarticle.cfm?SectionID=21&ItemID=7208> download date: 5-19-08]

Humanity has chosen to floor the consumer accelerator just as warnings of imminent catastrophe are piling up. Consider the impact, for example, of "global dimming" - the phenomenon by which tiny airborne particles of soot and other pollutants reflect sunlight back into space. The cooling effect of dimming, it seems, has offset the impact of global warming caused by industrial emissions of greenhouse gases. But with atmospheric particulate pollution being brought under control, this manmade break on climate change is being released. Scientists now believe temperatures could rise twice as fast as previously thought, with catastrophic and irreversible damage just twenty-five years away. ('Global Dimming', Horizon, BBC2, repeat broadcast, January 15, 2005; http://www.bbc.co.uk/sn/tvradio/programmes/horizon/dimming_trans.shtml) As the world heats up, reservoirs of frozen methane at the bottom of the ocean could melt, with consequences that would be terminal for human life: "At this point, whatever we did to curb our emissions, it would be too late. Ten thousand billion tons of methane... would be released into the atmosphere. The Earth's climate would be spinning out of control, heading towards temperatures unseen in four billion years. But this is not a prediction - it is a warning. It is what will happen if we clean up pollution while doing nothing about greenhouse gases. However, the easy solution - just keep on polluting and hope that Global Dimming will protect us - would be suicidal." (Horizon, ibid)

Carbon pricing encourages switches to alternatives and cuts in all the best places - achieves the quickest, most efficient reduction of greenhouse gases and pollution
Shapiro, 2007

[Robert J., "Addressing the Risks of Climate Change: The Environmental Effectiveness and Economic Efficiency of Emissions Caps and Tradable Permits, Compared to Carbon Taxes," former U.S. Undersecretary of Commerce for Economic Affairs during the Clinton

Administration, February, <http://www.aci-citizenresearch.org/Shapiro.pdf>]

Another critical economic issue is the degree to which a carbon tax would focus environmental improvements where they can be achieved most cheaply or efficiently - getting the biggest environmental bang for the dollar, Euro or yen. Cap-and-trade programs achieve this by using tradable permits: In principle, companies that can reduce their emissions enough to achieve their caps for less than the price of a permit can be expected to do that; while companies that would have to spend more to reduce their emissions than the price of a permit will



buy the permits from those who can do it more cheaply. In practice, Kyoto's 1990 base year sharply reduced this benefit by effectively relieving companies in Russia, Eastern Europe and Germany from making these calculations, along with companies in every developing nation. A global cap-and-trade program's special vulnerability to cheating will further reduce these potential gains: Many companies and countries are likely to bring their emissions under their caps by simply understating them, without bothering to invest in energy-efficient technologies, shift to alternative fuels or buy permits from others who have done so.

Carbon taxes can achieve this form of economic efficiency without a cumbersome trading mechanism susceptible to cheating and other distortions. The tax would raise the price of carbon-based energy in proportion to its carbon content, so that countries and companies that can reduce their carbon emissions for less than the cost of the tax can be expected to do so while those which find that reducing emissions would cost more than the tax will pay it. The consequent reductions in emissions should be greatest where the cost of achieving them is lowest, both within each country and worldwide, assuming that the world's major greenhouse gas producing countries sign on.



Contention 2: Carbon Pricing is a steal of a deal, the economy will be very happy

Carbon pricing is the best policy option - provides effective and efficient cuts, leads to more innovation, avoids corruption, eliminates burdensome federal regulations, stabilizes prices, is adjustable and predictable, has methods in place now to collect the tax, keeps the money in the United States for investment and innovation, and mitigates the economic damages of halting fossil fuel use.

Green, Hayward, and Hassett, 2007

Kenneth P. Green, Steven F. Hayward, Kevin A. Hassett, F. K. Weyerhaeuser Fellow, resident scholar, and senior fellow and director of economic policy studies at AEI, "Climate Change: Caps vs. Taxes," http://www.aei.org/publications/filter.all,pubID.26286/pub_detail.asp, June 1, ENVIRONMENTAL POLICY OUTLOOK, AEI Online, No. 2

There are many reasons for preferring a revenue-neutral carbon tax regime (in which taxes are placed on the

carbon emissions of fuel use, with revenues used to reduce other taxes) to emissions trading. Among them are: **Effectiveness and Efficiency.** A

revenue-neutral carbon tax shift is almost certain to reduce GHG emissions efficiently. As economist William Pizer observes, "Specifically, **a carbon tax equal to the damage per ton of CO₂ will lead to exactly the right balance between the cost of**

reducing emissions and the resulting benefits of less global warming."[10] Despite the popular assumption that a

cap-and-trade regime is more certain because it is a quantity control rather than a price control, such a scheme only works in very limited circumstances that do not apply to GHG control. The great potential for fraud attendant on such a system creates significant doubt about its effectiveness, as experience has shown in both theory and practice in the gyrations of the European ETS. The likelihood of effectiveness also cannot be said for regulations such as increased vehicle fuel economy standards. In fact, such regulations can have perverse effects that actually lead to increased emissions. By making vehicles more efficient, one reduces the cost of a unit of fuel, which would actually stimulate more driving, and, combined with increasing traffic congestion, could lead to an increase in GHG emissions rather than a decrease. As Harvard

researchers Louis Kaplow and Steven Shavell point out, "**The traditional view of economists has been that corrective**

taxes are superior to direct regulation of harmful externalities when the state's information

about control costs is incomplete," which, in the case of carbon emissions reductions, it most definitely is.[11] And

when it comes to quantity controls (as a cap-and-trade system would impose), Pizer found that My own analysis of the two

approaches [carbon taxes vs. emission trading] indicates that **price-based greenhouse gas (GHG) controls are**

much more desirable than quantity targets, taking into account both the potential long-term damages of climate

change, and the costs of GHG control. This can be argued on the basis of both theory and numerical simulations. Pizer found, in

fact, that **a carbon-pricing mechanism would produce expected net gains five times higher than**

even the best-designed quantity control (i.e., **cap-and-trade**) regime.[12] **Incentive Creation.** Putting a

price on the carbon emissions attendant on fuel use would create numerous incentives to reduce the use of carbon-intensive

energy. **The increased costs of energy would flow through the economy, ultimately giving**

consumers incentives to reduce their use of electricity, transportation fuels, home heating oil,

and so forth. Consumers, motivated by the tax, would have incentives to buy more efficient appliances, to buy and drive more

efficient cars, and to better insulate their homes or construct them with more attention to energy conservation. **A carbon**

tax would also create incentives for consumers to demand lower-carbon power sources from

their local utilities. A carbon tax, as its cost flowed down the chains of production into consumer products, would lead

manufacturers to become more efficient and consumers to economize in consumption. At all levels in the economy, a carbon tax would create a profit niche for environmental entrepreneurs to find ways to deliver lower-carbon energy at competitive prices.

Finally, **a carbon tax would also serve to level** (somewhat) **the playing field among solar power,**

wind power, nuclear power, and carbon-based fuels by internalizing the cost of carbon emission into the price

of the various forms of energy. **Less Corruption.** Unlike carbon cap-and-trade initiatives, **a carbon tax would create**

little incentive or opportunity for rent-seeking or cheating. As William Nordhaus explains: A price approach gives less room

for corruption because it does not create artificial scarcities, monopolies, or rents. There are no permits transferred to countries or leaders of countries, so they cannot be

sold abroad for wine or guns. . . . In fact, a carbon tax would add absolutely nothing to the instruments that countries have today.[13] Without the profit potential of

amassing tradable carbon permits, industry groups would have less incentive to try to get credits for their favored but non-competitive energy sources. That is not to say

that tax-based approaches are immune from corruption, for they certainly are not. If set too far down the chain of production or set unevenly among energy sources, carbon

taxes could well lead to rent-seeking, political favoritism, economic distortions, and so on. Foreign governments might have an incentive to undermine a trading scheme by

offering incentives to allow their manufacturers to avoid the cost of carbon trading. A tax on fuels proportionate to their carbon content, levied at the point of first sale,

should be less susceptible to corruption, and by delivering revenue to the government rather than to private entities, should create incentives more aligned with the

government's objective. **Elimination of Superfluous Regulations.** **Because a carbon tax would cause carbon emissions**

to be reduced efficiently across the entire market, other measures that are less efficient-- and

sometimes even perverse in their impacts--**could be eliminated.** With the proper federal carbon tax in place, there would be no need for

corporate average fuel economy standards, for example. California's emissions-trading scheme, likewise, would be superfluous, and its retention only harmful to the Golden

State. As regulations impose significant costs and distort markets, **the potential to displace a fairly broad swath of**



environmental regulations with a carbon tax offers benefits beyond GHG reductions. Price-Stabilization. As the experiences of the European ETS and California's RECLAIM show us, pollution-trading schemes can be easily gamed, resulting in significant price volatility for permits. Imagine one's energy bill jumping around as permits become more or less available in economic conditions. A carbon tax would be predictable, and by raising the overall price of energy to include the tax, the portion of energy cost per unit that stems from fluctuation in market rates for fossil fuels shrinks as a percentage of the whole. That shrinkage makes the price of a given form of energy less susceptible to volatility every time there is a movement in the underlying production costs. Adjustability and Certainty. A carbon tax, if found to be too stringent, could be relaxed relatively easily over a timeframe, allowing for markets to react with certainty. If found too low to produce results, a carbon tax could easily be increased. In either event, such changes could be phased in over time, creating predictability and allowing an ongoing reassessment of effectiveness via observations about changes in the consumption of various forms of energy. A cap-and-trade system, by contrast, is more difficult to adjust because permits, whether one is the seller or the buyer, reflect significant monetary value. Permit traders would demand--and rightly so--compensation if what they purchased in good faith has been devalued by a governmental deflation of the new "carbon currency." In addition, sudden changes in economic conditions could lead to significant price volatility in a cap-and-trade program that would be less likely under a carbon-tax regime. Preexisting Collection Mechanisms. Whether at local, state, or federal levels, carbon taxes could be levied and collected through existing institutions with extensive experience in enforcing compliance, and through ready-made statutes to back up their actions. The same cannot be said for emissions-trading schemes that require the creation of new trading markets, complete with new regulations and institutions to define and enforce the value of credits. Keeping Revenue In-Country. Unlike an international cap-and-trade regime, carbon taxes--whether done domestically or as an internationally agreed-upon value--have the advantage of keeping tax payments within individual countries. This could strongly reduce the opposition to international action that has, until this point, had a strong implication of wealth redistribution overlaid on the policy discussion. This dynamic leads to a second reason why a carbon tax is a better fit for U.S. climate policy: it offers an international analogue to our federalist approach to public policy innovation within the United States. As we have seen, there is reason to doubt the long-run effectiveness and sustainability of the EU's emissions-trading program. If the United States adopts a carbon tax approach, we will be able to compare the effectiveness of tax versus emissions trading in short order.

Carbon pricing would mitigate climate change in a cost effective manner over time and prevent corporate flight to pollution havens.

Clark 2012 [Grantham Research Institute and Duncan Clark; "What is a carbon price and why do we need one?" Monday 16 July 2012 <http://www.theguardian.com/environment/2012/jul/16/carbon-price-tax-cap>]

A carbon price is a cost applied to carbon pollution to encourage polluters to reduce the amount of greenhouse gas they emit into the atmosphere. Economists widely agree that introducing a carbon price is the single most effective way for countries to reduce their emissions. Climate change is considered a market failure by economists, because it imposes huge costs and risks on future generations who will suffer the consequences of climate change, without these costs and risks normally being reflected in market prices. To overcome this market failure, they argue, we need to internalise the costs of future environmental damage by putting a price on the thing that causes it - namely carbon emissions. A carbon price not only has the effect of encouraging lower-carbon behaviour (eg using a bike rather than driving a car), but also raises money that can be used in part to finance a clean-up of "dirty" activities (eg investment in research into fuel cells to help cars pollute less). With a carbon price in place, the costs of stopping climate change are distributed across generations rather than being borne overwhelmingly by future generations. There are two main ways to establish a carbon price. First, a government can levy a carbon tax on the distribution, sale or use of fossil fuels, based on their carbon content. This has the effect of increasing the cost of those fuels and the goods or services created with them, encouraging business and people to switch to greener production and consumption. Typically the government will decide how to use the revenue, though in one version, the so-called fee-and-dividend model - the tax revenues are distributed in their entirety directly back to the population. The second approach is a quota system called cap-and-trade. In this model, the total allowable emissions in a country or region are set in advance ("capped"). Permits to pollute are created for the allowable emissions budget and either allocated or auctioned to companies. The companies can trade permits between one another, introducing a market for pollution that should ensure that the carbon savings are made as cheaply as possible. To serve its purpose, the carbon price set by a tax or cap-and-trade scheme must be sufficiently high to encourage polluters to change behaviour and reduce pollution in accordance with national targets. For example, the UK has a target to reduce carbon emissions by 80% by 2050, compared with 1990 levels, with various intermediate targets along the way. The government's independent advisers, the Committee on Climate Change, estimates that a carbon price of £30 per tonne of carbon dioxide in 2020 and £70 in 2030 would be required to meet



these goals. Currently, many large UK companies pay a price for the carbon they emit through the EU's emissions trading scheme. However, the price of carbon through the scheme is considered by many economists to be too low to help the UK to meet its targets, so the Treasury plans to make all companies covered by the scheme pay a minimum of £16 per tonne of carbon emitted from April 2013. Ideally, there should be a uniform carbon price across the world, reflecting the fact that a tonne of carbon dioxide does the same amount of damage over time wherever it is emitted. Uniform pricing would also remove the risk that polluting businesses flee to so-called "pollution havens" - countries where a lack of environmental regulation enables them to continue to pollute unrestrained. At the moment, carbon pricing is far from uniform but a growing number of countries and regions have, or plan to have, carbon pricing schemes in place, whether through cap-and-trade or carbon taxes. These include the European Union, Australia, South Korea, South Africa, parts of China and California.

No negative impact to economy, companies are ready and willing to go silently into the carbon pricing night.

Kahn 2015 [Brian Kahn "In Stunning Reversal, 'Big Oil' Asks for Carbon Price" June 1st, 2015 <http://www.climatecentral.org/news/oil-companies-carbon-price-19054>]

Let's see if you can guess the source for the following quote. "We want to be a part of the solution and deliver energy to society sustainably for many decades to come." If you guessed a major solar, wind or renewable energy company, you'd be wrong. If you guessed six of the world's largest oil and gas companies, give yourself a gold star. In a stunning reversal of years of obstructionism to creating a global framework to deal with climate change, CEOs from global oil and gas behemoths Shell, BP, Total, Statoil, Eni and the BG Group have signaled that they're ready for a price on carbon. The CEOs of the companies, with nearly \$1.4 trillion in annual revenue, sent a letter on Friday, which was released publicly on Monday, to Christiana Figueres, the United Nation's climate chief, as well as Laurent Fabius, France's Foreign Affairs and International Development Minister who will also lead the Paris climate talks later this year. In it, they ask for national and regional governments to set a price on carbon and for those regional carbon markets to be linked. "We need governments across the world to provide us with clear, stable, long-term, ambitious policy frameworks," the letter states. The timing of the letter is no coincidence. Representatives from 190 countries are meeting in Bonn, Germany this week to continue hammering out details for an international climate agreement that is expected to take shape by the end of the year. The desire for a price on carbon might seem anathema to companies that make much of their billions from extracting oil and gas, two of the main drivers of carbon dioxide emissions that are warming the planet. And make no mistake, the six companies are not talking about getting out of the oil and gas business anytime soon. In fact, a separate letter to the media highlights natural gas as an important bridge fuel. And despite signing the letter, Shell is also headed back to the Arctic this summer to drill for oil. But in the big picture, the lack of a price on carbon creates an uncertain environment for companies that tend to plan decades into the future. The sooner a price is set, the quicker companies can adjust their plans for future profitability. In addition, there's been growing pressure from shareholders that want more clarity on how oil companies plan to continue making money in a world where carbon emissions need to decline in order to avoid the worst impacts of climate change. The growing power of the divestment movement, which aims to get pension funds and endowments to remove fossil fuel companies from their portfolio, is also posing a growing issue for fossil fuel companies. "The investors have really woken up in the past 12 months," Frances Way, co-chief operating officer of programs at CDP, said. "There's a push to ask that as a responsible investor, should they be supporting oil and gas at this point." CDP works with investors and companies interested in planning for the impacts of climate change and how to reduce emissions. For fossil fuel companies, reducing emissions means reimagining what kind of company they are. "It depends if you see it as a fossil fuel business or an energy business. Can they can diversify and change over time?" Way said. "I feel a number of individuals are trying to get a point of dialogue about the strategy and risk and being more transparent." Figueres has said she wants to have fossil fuel companies at the table for climate talks. The letter signals a willingness that they'll be pulling up a seat as good guests and not party crashers.



AFF CARDS/A2's

We are reaching the Point of No Return - cuts in CO₂ are needed now

Gelbspan 2005

[People's Ratification Of The Kyoto Global Warming Treaty by Ross Gelbspan February 17, 2005, Grist Magazine
<http://www.zmag.org/content/showarticle.cfm?SectionID=56&ItemID=7266> download date: 5-19-08]

In late January, Rajendra Pachauri, chair of the Intergovernmental Panel on Climate Change, declared that the world has "already reached the level of dangerous concentrations of carbon dioxide in the atmosphere" and called for immediate and "very deep" cuts in emissions if humanity is to survive. Pachauri's declaration came alongside new findings unveiled on Jan. 24 by a commission of scientists from the U.S., the U.K., and Australia, which declared that the world is about 10 years -- or about 2 degrees Fahrenheit -- away from irreversible climate change. The scientists calculated that the "point of no return" will arrive when concentrations of atmospheric carbon dioxide reach 400 parts per million (ppm). For most of the 20th century, these carbon concentrations increased by about 1 ppm per year. In recent decades, that rate rose to 1.5. Today it's more than 2 ppm per year. Grand total: 379 ppm, and counting. It's a level of atmospheric carbon this planet has not experienced for 420,000 years.



Carbon pricing is the best way to reduce greenhouse gasses and promote alternative energy - solves 11% of greenhouse gasses for every 15\$ of carbon tax established.

Green, Hayward, and Hassett, 2007

[Kenneth P. Green, Steven F. Hayward, Kevin A. Hassett, F. K. Weyerhaeuser Fellow, resident scholar, and senior fellow and director of economic policy studies at AEI, "Climate Change: Caps vs. Taxes," http://www.aei.org/publications/filter.all,pubID.26286/pub_detail.asp,

June 1, ENVIRONMENTAL POLICY OUTLOOK, AEI Online, No. 2]

A program of carbon-centered tax reform, by contrast, lacks most of the negative attributes of cap-and-trade, and could convey significant benefits unrelated to GHG reductions or avoidance of potential climate harms, making this a no-regrets policy. A tax swap would create economy-wide incentives for energy efficiency and lower-carbon energy, and by raising the price of energy would also reduce energy use. At the same time, revenues generated would allow the mitigation of the economic impact of higher energy prices, both on the general economy and on the lower-income earners who might be disproportionately affected by such a change. Carbon taxes would be more difficult to avoid, and existing institutions quite adept at tax collection could step up immediately. Revenues would remain in-country, removing international incentives for cheating or insincere participation in carbon-reduction programs. Most of these effects would remain beneficial even if science should determine that reducing GHG emissions has only a negligible effect on mitigating global warming. A modest carbon tax of \$15 per ton of CO₂ emitted would result in an 11 percent decline in CO₂ emissions, while raising non-coal-based energy forms modestly. Coal-based energy prices would be affected more strongly, which is to be expected in any plan genuinely intended to reduce GHG emissions. A number of possible mechanisms are available to refund the revenues raised by this tax. On net, these tools could significantly reduce the economic costs of the tax and quite possibly provide economic benefits. For these reasons, we conclude that if aggressive actions are to be taken to control GHG emissions, carbon-centered tax reform--not GHG emission trading-- is the superior policy option.



Carbon pricing would best encourage the switch to renewables

Shapiro 2007

[Robert J., "Addressing the Risks of Climate Change: The Environmental Effectiveness and Economic Efficiency of Emissions Caps and Tradable Permits, Compared to Carbon Taxes," former U.S. Undersecretary of Commerce for Economic Affairs during the Clinton

Administration, February, <http://www.aci-citizenresearch.org/Shapiro.pdf>]

Carbon taxes also should provide greater incentives for companies to develop new, environmentally-friendly technologies or abatement strategies than a cap-and-trade program.

The tax would provide "a continual incentive to reduce the costs of carbon abatement,"⁶⁶ as a leading energy economist put it, because **the permanent increase in the cost of carbon-intensive energy would raise the rate of return on the development and use of technologies that reduce the consumption of those forms of energy.** Cap-and-trade provides less powerful incentives in this respect, because its impact on energy prices is less constant and more volatile. And under flawed versions of the cap-and-trade strategy, such as Kyoto-based targets, the availability of excess permits further weakens the incentives to develop and use alternative fuels and more energy-efficient technologies.



Carbon pricing solves for pollution at every point of the cycle

Kriz 2007

[Margaret, "Dingell's Dare," the National Journal, October 20, download date" 6-90-08]

But carbon-tax supporters say that Dingell is only stating the obvious: A tax may be necessary to curb global warming. "I think there is a growing understanding of how bad cap-and-trade is," AEI's Green said. "And if that sentiment continues to grow, more people will say, 'Look, we need to bring a positive alternative to the table.' And what they're left with is going to be a carbon tax." Industry associations say that their members are split on how to address global warming. A lobbyist with one group estimated that about 40 percent of his members favor a cap-and-trade plan and the rest are evenly divided between supporting a carbon tax and opposing all controls on greenhouse gases. But cap-and-trade proponents might jump ship, he said, if Congress were to write a bill that they believed disadvantaged their companies. "If I were going to handicap the race, I would say, long term there is a better chance for a carbon tax because they can make it apply to everything, including products coming into the country," he said. "Industry's biggest concern is, 'Is this going to be fair?' A carbon tax is perceived as being fair."



Carbon pricing should be implemented on the federal level - it's the only way to fairly spread the cost of the plan around

Einholf 2007

[David M., formerly a managing partner in Energy Resources Management, Daily Journal of Commerce (Portland, OR), "Carbon and the Pacific Northwest, effective emissions control," November 13]

On the other hand is the carbon tax, which would place a charge on the carbon emissions generated by any fossil fuel (e.g. coal, natural gas, oil products). Carbon taxes are favored by utilities with a majority of renewable, natural gas, or nuclear resources in their portfolios. Many conservative economists have also embraced the carbon tax as a potential replacement for some personal and corporate income taxes. Economists estimate that a tax of \$10 per metric ton of carbon dioxide emissions (the common measure) could yield more than \$50 billion per year to the treasury, assuming some reductions from a 2005 baseline. As with cap and trade, a carbon tax has its pros and cons. As an economic policy, a carbon tax would be simple to implement at the national level. It would largely affect utilities and oil producers, who would simply pass it through to their customers. Estimates of the effect of a \$10 per Megaton carbon dioxide tax are an increase of \$0.024 cents per gallon of gas and \$0.0017 per kilowatt-hour of electricity, less than a 2 percent increase. As a tax, however, it would affect the poor and small business disproportionately, as they pay a greater part of their income for oil and electricity. Lastly, a carbon tax is only truly effective if it is instituted as a national policy. Carbon taxes at the local level would be difficult to enforce (especially since power is not entirely locally generated) and would result in business moving out of the state or region. Meeting the aggressive requirements of Oregon's greenhouse gas reduction program will be difficult for Oregon's utilities and large businesses using fossil fuels, regardless of which system is adopted to promote reductions. A national policy leading to a carbon tax would spread the cost more widely to consumers.



Federal oversight ensures adequate communication between aspects of the electric grid which is vital for reliability

Makovich 2003

[CERA Senior Director for Americas Gas and Power Research, Lawrence J., "Contributing events and causes of the blackout," Federal News Service, September 4]

Transmission organizations need to reflect the underlying reality of the transmission infrastructure. We do not have a seamless, national transmission grid and are not even close to having one. Instead, the US power system consists of a dozen regional transmission networks within three largely independent transmission interconnections, with varying levels of power transfer capability between regional networks and with networks in Canada. These networks cover multistate areas and need organizations that align with the physical extent of the grids to implement the necessary planning, coordination, communication, and control. Thus, the Federal Energy Regulatory Commission (FERC) should not allow movement to the market in regions that do not have proper alignment between the transmission organization and the network. Currently, the US Midwest network has two transmission organizations in formation and transition, rather than one, and suffers a misalignment between the organizations and the underlying extent of the regional network. On the other hand, if the FERC gains authority to order regional transmission organization participation in regions moving to the market, then it should also order proper alignment between transmission organizations and networks. Since these regional networks do have significant interconnections, the need also exists for an umbrella organization to coordinate operations and interdependencies within the interconnections. We want sufficient overall control to avoid situations in which one regional network protects itself by causing collapses in neighboring networks. The current NERC comes close to the envisioned umbrella organization but suffers from being a voluntary organization with limited enforcement authority. Mandatory electric reliability standards and procedures would help address the breakdown in planning, coordination, and communication that are at the foundation of power system control. A system of rules and procedures is needed that provides real- time information flows such that all system operators have a clear view of not just their local power system but also the larger whole. Such standards and procedures need to be enforced by an agency with authority over both publicly and privately owned transmission assets in competitive as well as regulated industry structures. International agreements are also necessary to coordinate with Canadian power systems and, to a much smaller extent, Mexican power systems. An umbrella organization must ensure that contingency planning evaluates the power system as a whole-and is not just an uncoordinated set of regional contingency plans with a blind spot regarding their interdependencies.



Carbon pricing is modelled globally, and if the money is invested in renewables and alternatives, the US can trade those technologies to countries to help them reduce their emissions

Shapiro 2007

[Robert J., "Addressing the Risks of Climate Change: The Environmental Effectiveness and Economic Efficiency of Emissions Caps and Tradable Permits, Compared to Carbon Taxes," former U.S. Undersecretary of Commerce for Economic Affairs during the Clinton

Administration, February, <http://www.aci-citizenresearch.org/Shapiro.pdf>]

The risks of climate change continue to grow. Global, harmonized net carbon taxes could contain those risks in an economically-efficient and politically-feasible way. The task is to persuade the world's major energy producing and energy consuming countries to adopt them. The United States has a singular role to play in this regard. As the world's largest producer of greenhouse gases, the United States has a special responsibility to implement an effective and efficient strategy for reducing those emissions. Moreover, as the leading developer of new technologies, the United States can use its technological capacity to develop alternative fuels and more energy-efficient and carbon-reducing technologies. A carbon tax would both directly reduce greenhouse gas emissions and provide powerful incentives for technological progress in this area. It offers best way forward in the national and global debate over climate change.



Pricing would integrate into the world cap-and-trade system easily

Orszag, Director, Congressional Budget Office, 2008

[Peter R., Director of the Congressional Budget Office, The Congress of the United States, Before joining CBO in January 2007, Dr. Orszag was the Joseph A. Pechman Senior Fellow and Deputy Director of Economic Studies at the Brookings Institution , Ph.D. in Economics

from the London School of Economics, February 2008, "Policy Options for Reducing CO2 Emissions," CBO Study No. 2930]

A tax on emissions would be the most efficient incentive-based option for reducing emissions and could be relatively easy to implement. If it was coordinated among major emitting countries, it would help minimize the cost of achieving a global target for emissions by providing consistent incentives for reducing emissions around the world. If other major nations used cap-and-trade programs rather than taxes on emissions, a U.S. tax could still provide roughly comparable incentives for emission reductions if the tax rate each year was set to equal the expected price of allowances under those programs. (See Summary Table1 for a qualitative comparison of selected policies.)



Current state policies are patchwork and need a federal program to unify and streamline the transition to renewables

Herzog et. al., 2001

[Antonia V. Herzog, Timothy E. Lipman, Jennifer L. Edwards, and Daniel M. Kammen, *Environment*, Vol. 43 No. 10 (December 2001), RENEWABLE ENERGY: A VIABLE CHOICE, http://www.nrel.gov/analysis/seminar/pdfs/2004/ea_seminar_sept_20_2.pdf]
Analysis of the RPS target for 2020 shows renewable energy development in every region of the country, with most coming from wind, biomass, and geothermal sources. In particular, the Plains, Western, and mid-Atlantic states would generate more than 20 percent of their electricity from renewables. Texas has become a leader in developing and implementing a successful RPS that then-Governor Bush signed into law in 1999. The Texas law requires electricity companies to supply 2,000 MW of new renewable resources by 2009, and the state is actually expected to meet this goal by the end of 2002, seven years ahead of schedule. Nine other states have signed an RPS into law: Arizona, Connecticut, Maine, Massachusetts, Nevada, New Jersey, New Mexico, Pennsylvania, and Wisconsin. Minnesota and Iowa have a minimum renewables requirement similar to an RPS, and legislation that includes an RPS is pending in several other states. While the participation of 12 states signals a good start, this patchwork of state policies would not be able to drive down the costs of renewable energy technologies and move these technologies fully into the marketplace. Also, state RPS policies have differed substantially from each other thus far. These differences could cause significant market inefficiencies, negating the cost savings that a more comprehensive, streamlined, market-based federal RPS package would provide



Carbon pricing has a five to eight times greater chance of succeeding than the status quo cap-and-trade system

Orszag, Director, Congressional Budget Office, 2008

[Peter R, Director of the Congressional Budget Office, Ph.D. in Economics, London School of Economics, February, "Policy Options for Reducing CO2 Emissions," CBO Study No. 2930]

When analysts take into account the degree to which costs are likely to vary around a single best estimate, they conclude that a tax could offer much higher net benefits than a cap. One study suggests that the net benefits of a worldwide tax on CO2 emissions in 2010 would be more than eight times larger than those of an equivalent inflexible cap. If the policies are assumed to be set in place for 100 years, the efficiency advantage of a tax declines to a factor of five.⁹ Another study concluded that a tax could offer up to 16 times greater expected net benefits than a cap under some assumptions.¹⁰ A third study examined outcomes when cost shocks were assumed to be correlated across time—that is, an unusually high cost of meeting the cap in any given year increases the likelihood of a higher than average cost in the following year. Using their base-case parameter estimates for factors that might affect costs (such as baseline emissions and changes in technology) and assuming a 10-year policy, those researchers estimated that the net benefits of a tax would be roughly five times higher than those of a cap.¹¹ Taken together, those studies suggest that the net benefits of a tax could be roughly five times those of an inflexible cap (see Figure 1-2)—assuming that both policies were designed to balance expected costs and benefits. Viewed another way, any long-term emission-reduction target could be met by a tax at a fraction of the cost of an inflexible cap-and-trade program. That cost savings stems from the fact that a tax could better accommodate cost fluctuations while simultaneously achieving a long-term emission target. It would provide firms with an incentive to undertake more emission reductions when the cost of doing so was relatively low and allow them to reduce emissions less when the cost of doing so was particularly high.



Carbon pricing encourages more voluntary reductions in emissions, companies that want to save will reduce emissions while the price is still low

Inside Green Business, 2007

[“Advocates Say Carbon Tax Rewards Early Action More than Cap-and-Trade,” Vol2, No 10, March 7]

Companies that have voluntarily reduced their greenhouse gas (GHG) emissions in preparation for likely federal climate change regulations **would benefit more from a carbon tax** than a cap-and-trade system, says a source with the Carbon Tax Center (CTC), a newly-formed group advocating carbon taxes as a GHG mitigation policy. **A carbon tax would avoid the complexities of establishing baselines and allocating emission allowances**, which may favor certain types of companies more than others, a CTC source says. **A tax on carbon emissions would reward all reductions equally because any company that cut emissions would inherently reduce its tax liability**. A growing number of companies are committing to reducing emissions voluntarily in hopes that a mandatory climate change mitigation system will award credit to companies that act early. The Chicago Climate Exchange (CCX), for instance, allows companies to set and meet voluntary reduction targets through credit trading, while the California Climate Action Registry (CCAR) helps companies measure emission levels so verified baselines can be established under a regulatory system. The Department of Energy also has a voluntary emissions reporting program, known as “1605b.”



Net benefit of carbon pricing over the status quo is five times greater

Orszag, 2008

[Director of the CBO, The Congress of the United States, Congressional Budget Office, February, "Policy Options for Reducing CO2 Emissions," CBO Study No. 2930]

The efficiency advantage of a tax over an inflexible cap depends on how likely it is that actual costs will differ from what policymakers anticipated when they set the level of the cap. Given the uncertainties involved, such differences are likely to be large—and, therefore, analysts generally conclude that the efficiency advantage of a tax is likely to be quite large. Specifically, available research suggests that in the near term, the net benefits (benefits minus costs) of a tax could be roughly five times greater than the net benefits of an inflexible cap.² Put another way, a given long-term emission-reduction target could be met by a tax at a fraction of the cost of an inflexible cap-and-trade program.



Industry is trying to build more coal plants - a carbon pricing system would discourage the building of new plants and reduce global warming.

Kriz 2007

[Margaret, "Dingell's Dare," the National Journal, October 20

For business, a carbon tax would likely provide more certainty about the future. Although a cap-and-trade program would tightly rein in the amount of global-warming pollution that industries could emit each year, company executives could not be sure in advance how much it would cost them to meet the government's environmental goals, because the cost of a carbon credit would fluctuate. In contrast, a carbon tax would specify how much money a company would owe per ton of greenhousegas pollution emitted. On the downside, economists concede that it's hard to predict how high a carbon tax would need to be to drive down greenhouse-gas emissions. A study by the American Enterprise Institute, a conservative think tank, suggested that a carbon tax of \$15 per ton of carbon dioxide emission would reduce global-warming pollution by 11 percent. "Yes, it's an assumption," said AEI resident scholar Kenneth Green, who co-authored the June study. "But it's an assumption based on something that is as close to a law as economics has -- that is: If you increase price, you'll decrease demand." Paul Portney, dean of the University of Arizona's College of Management, said that a carbon tax would send clear price signals to the market that would encourage companies and the public to pollute less. "We can start small, and the tax will go up gradually but predictably over time so that people can plan," said Portney, the former president of Resources for the Future, a think tank that focuses on the economics of environmental policy. "They'll know that in the future, if they're buying a new car, they're going to be paying more for gas." Pope predicts that a carbon tax would discourage electric utilities from constructing more coal-fired power plants to help meet America's growing demand for power and that they would instead turn to generators that play little or no role in global warming. The Energy Department says that the industry has more than 100 coal plants on the drawing board. "If investors know they'll be paying more to operate coal plants, they'll stop building them," Pope said.



People will stop emitting pollution and greenhouse gases because they know the prices will continue to go up

Rosenblum 2007

[Daniel, an environmental attorney and cofounder of the Carbon Tax Center in New York City, Originally Aired: April 11, 2007, News Hour Transcript, PBS, Interview with Ray Suarez, Carbon Tax Aims to Cut Greenhouse Gases, http://www.pbs.org/newshour/bb/environment/jan-june07/climatechange_04-11.html

RAY SUAREZ: Well, how do we know, then, that raising the tax will actually decrease usage or decrease emissions? Just in the past few years, we've seen gas go from 99 cents a gallon to \$3.50, and it hasn't had too much an impact on the way people drive or how many miles they drive. DANIEL ROSENBLUM: You expect to have gas and consumption rise with GDP. As the economy grows, gasoline consumption grows. Gasoline consumption has not grown as much as the economy, and that suggests there has, in fact, been a very real impact of higher prices. And that goes back and forth, and people are subject to kind of wide changes in the market recently. But when you have a very clear trajectory going up, you're going to have a different message to consumers. Right now, they don't know if it's going to go up half a dollar next week and down a dollar next week or the week after. Under a carbon tax, they're going to know. They're going to know that a carbon tax is going up, and up, and up, and up. There's no getting around it, so they're going to know they're going to have to respond to it, and they haven't had that information.



Carbon pricing will level the playing field by making fossil fuel energy more expensive and alternatives more worthwhile to invest in - Carbon pricing is also the best way to solve a warming crisis that has an invisible threshold for catastrophe
Gillentine, 2007

[Amy, Colorado Springs Business Journal, February 23, 2007, "Carbon tax takes lead over emissions capping"]

A carbon tax - based on emissions from cars, homes, power plants and corporations - is more likely to successfully lower carbon dioxide in the atmosphere than a carbon trading system.

That's the word from the Congressional Budget Office, as well as environmental analysts. Both groups say that a carbon tax would be more efficient than emissions capping. And Dr. Walt Hecox of Colorado College believes a carbon tax would more efficiently lower carbon emissions. "It's what economists call a negative externality," he said. "Taxes are assessed based on the type of fuel used and how much carbon it releases. And the tax revenue could be used to mitigate the cost to the poor, or to invest in alternative energy sources." Carbon trading - on a commodities market, where a cap is set and companies who emit less carbon than the cap can sell the remainder to another company - is based in the private sector, Hecox said. Europe introduced a carbon emissions market after the 1997 Kyoto Protocol, he said, although the market has faced some big problems. "The problem is they over-estimated the number of permits," he said. "So the price has fallen. With a cap-trade system, there's no revenue for the government, no real incentive to invest in other sources of energy." The United States has a single, voluntary carbon emissions trading system: The Chicago Climate Exchange. It is selfregulating and voluntary, but legally binding. The group requires members to reduce emissions by 6 percent below the Kyoto baseline no later than 2010. The exchange opened in 2001, and carbon is traded, much like any other commodity. Just like any commodity, the price fluctuates. The cumulative trading volume between March 2003 and May 2006 reached 6.5 million metric tons. The CBO researched the issue in 2005, and decided that the carbon tax would be a better effort than a cap-and-trade system. "Neither the costs nor benefits (of reducing emissions) are known with certainty," the CBO said in its report to Congress. "For that reason, the best policy makers can do is to choose the policy instrument that is most likely to minimize the cost of making a 'wrong' choice." "Because the cost of controlling carbon is unknown, most economists believe the best idea is one that controls price, not quantity. The amount of carbon dioxide produced when a fuel is burned is a known quantity, experts say, and a price can easily be fixed to it. It's going to make carbon-based energy more expensive," said Colorado School of the Mines Professor J. Thomas McKinnon. "And it will force companies and people to be more efficient. It will level the playing field for non-carbon based fuels, give incentives for investment in wind energy or solar centric power companies. There's a lot of room for innovation if the playing field is level." The CBO noted that a cap-trade system doesn't allow for flexibility. Because the costs of reducing emissions is unknown, a cap system might not allow enough financial incentives if actual costs are much higher than anticipated costs. "The less information policymakers have about the cost of meeting a particular emission cap, the greater the advantage offered by an emission price," the report said. "The cost of meeting a given cap on carbon emissions is likely to be difficult to estimate for at least three reasons. First, the cost of meeting a future cap would vary significantly with the amount of growth in carbon emissions in the interim. ... Second, policymakers have less information about the cost of controlling emissions than do the firms that create them. Third, the cost of meeting the future cap will depend on the technologies that are developed to reduce carbon dioxide emissions and the economic consequences of adopting those technologies - neither of which can be predicted with certainty." One group that is interested in leveling the playing field is the New York City-based Carbon Tax Center. In its plan, the tax - which starts at 10 cents for a gallon of gas, and increases in 10-cent increments during a 10-year period - would be "revenue neutral," said co-founder Charles Komanoff. "The money could be spent in two ways: we could give it back to the taxpayer, much like they do the income from the Alaskan oil pipeline," he said. "Or it could be used to lower Social Security payments. Our plan isn't to put the money into alternative fuels or to subsidize an industry." Komanoff said the organization believes the carbon tax is "more fair, more understandable." "We can get it into place quicker, and it will cover all uses of carbon fuels," he said. "It will exclude those financial types hovering at the trough." But Komanoff's group isn't the only one interested in a carbon tax. Many national and multinational companies are supporting a national carbon tax - as opposed to various state taxes and a myriad of international taxes. "Many of these large companies think the worst thing to do is have 50 different taxes when they're trying to do business," Hecox said. "They know some kind of change is inevitable and they prefer a single, national tax, a multinational tax would be even better in their view." Pressure from businesses will lead to legislation by the end of President Bush's current term, he said. The European Union is threatening to impose a carbon tax on American imports. "It's probably not legal under the WTO (World Trade Organization)," he said. "But they're going to try it if the United States doesn't take some steps of its own. That's increasing the pressure to get something done sooner." The Congressional Budget Office says the uncertainty about climate change science - if there is a specific temperature that will trigger catastrophic damages - lends more credence to a carbon tax than a cap and trade system. If there is uncertainty about either the existence or the level of a trigger temperature - as is currently the case - the potential advantages of an emission cap decline," the CBO report said. "Under those circumstances,



it is no longer clear whether, or at what level, to set a cap to avoid a catastrophic outcome. ... A price instrument is generally superior if damages are expected to grow, but at a gradual rate of increase. "

Graduated carbon pricing will NOT harm the economy and spurs innovation

Levin, President, Yale University, April , 2008

[Richard C., "Greenhouse Gas Emissions and Higher Education" CQ Congressional Testimony]

Before commenting on the big question, let me make a couple of additional observations. First, whether one sets taxes or emissions quotas, most economists favor gradualism, for compelling reasons. Adjustment in the short run is much more costly than adjustment over a decade or two, when energy- inefficient capital equipment and motor vehicles can be phased out gradually in favor of more efficient alternatives. What is essential for the efficient operation of either a tax or a capand- trade regime is that individuals and businesses know what their taxes or allowances will be well into the future. A gradually rising tax on carbon or a gradually falling quota on carbon emissions that is credible will be sufficient to elicit socially optimal investment decisions, both in the deployment of existing technologies and in the development of new technologies. It imperative that we act soon but it is not necessary to impose high taxes or low quotas immediately.



Actual cost of carbon pricing to the industry will be low

Levin, President of Yale University, April 3, 2008

[Richard C., "Greenhouse Gas Emissions and Higher Education" CQ Congressional Testimony]

So, how high a carbon price do we need? To reduce annual global emissions 25% by 2050, the Stern Review finds that we would require a carbon tax (or a market price of tradable emissions allowances) in the range of \$350- 400 per ton of carbon by 2015, rising to more than \$600 per ton by 2050.

Fortunately, my Yale colleague, William Nordhaus, demonstrates convincingly that Stern's estimate is too high. Nordhaus' own model indicates the same reduction in emissions can be achieved by a carbon price that rises gradually from \$35 per ton in 2015 to about \$100 per ton in 2050.



Uncertainty of climate change is far worse for business than the impact of carbon pricing

Shapiro and Carey, 2004

[John and Sarah R., Business Week, 8/30/04, Pg. 48 Vol. 3897, "Global Warming;"]

Consensus is growing among scientists, governments, and business that they must act fast to combat climate change. This has already sparked efforts to limit CO2 emissions. Many companies are now preparing for a carbon constrained world When CEOs contemplate global warming, they see something they dread: uncertainty. There's uncertainty about what regulations they will have to meet and about how much the climate will change -- and uncertainty itself poses challenges.

Insurance giant Swiss Re sees a threat to its entire industry. The reason: Insurers know how to write policies for every conceivable hazard based on exhaustive study of the past. If floods typically occur in a city every 20 years or so, then it's a good bet the trend will continue into the future. Global warming throws all that historical data out the window. One of the predicted consequences of higher greenhouse-gas levels, for instance, is more variable weather. Even a heat wave like the one that gripped Britain in 1995 led to losses of 1.5 billion pounds, Swiss Re calculates. So an increase in droughts, floods, and other events ``could be financially devastating," says Christopher Walker, a Swiss Re greenhouse-gas expert. That's why Swiss Re has been pressing companies to plan for possible effects of warming. Lenders may require beefed-up flood insurance before issuing mortgages. Chipmakers must find replacements for greenhouse-gas solvents. Utilities need to prepare grids to handle bigger loads and to boost power from renewable sources. Oil companies need to think about a future where cars use less gas -- or switch to hydrogen. Swiss Re says the word is getting out, but not fast enough. In a recent survey, ``80% of CEOs said that climate change was a potential risk, but only 40% were doing something about it," says Walker. ``That's not good to hear for insurers."



Political action is key to spurring individual and local actions to reduce warming, carbon pricing is the best method to do this

McKibben, Middlebury College, 2006

[Bill, scholar in residence at Middlebury College, "How Close to Catastrophe?" October 23, <http://www.zmag.org/znet/viewArticle/2904> download date: 5-19-08]

There's another way of saying what is missing here. Almost every idea that might bring us a better future would be made much easier if the cost of fossil fuel was higher -- if there was some kind of a tax on carbon emissions that made the price of coal and oil and gas reflect its true environmental cost. (Gore, in an important speech at New York University last month, proposed scrapping all payroll taxes and replacing them with a levy on carbon.) If that day came -- and it's the day at least envisioned by efforts like the Kyoto Treaty -- then everything from solar panels to windmills to safe nuclear reactors (if they can be built) would spread much more easily: the invisible hand would be free to do more interesting work than it's accomplishing at the moment. Perhaps it would actually begin to operate with the speed necessary to head off Lovelock's nightmares. But that will only happen if local, national, and international officials can come together to make it happen, which in turn requires political action. The recent election-driven decision by California governor Arnold Schwarzenegger to embrace a comprehensive set of climate change measures shows that such political action is possible; on the other side of the continent, a Labor Day march across Vermont helped to persuade even the most right-wing of the state's federal candidates to endorse an ambitious program against global warming. The march's final rally drew a thousand people, which makes it possibly the largest global warming protest in the country's history. That's a pathetic fact, but it goes to show how few people are actually needed to begin working toward real change. The technology we need most badly is the technology of community -- the knowledge about how to cooperate to get things done. Our sense of community is in disrepair at least in part because the prosperity that flowed from cheap fossil fuel has allowed us all to become extremely individualized, even hyperindividualized, in ways that, as we only now begin to understand, represent a truly Faustian bargain. We Americans haven't needed our neighbors for anything important, and hence neighborliness -- local solidarity -- has disappeared. Our problem now is that there is no way forward, at least if we're serious about preventing the worst ecological nightmares, that doesn't involve working together politically to make changes deep enough and rapid enough to matter. A carbon tax would be a very good place to start.



Graduated Carbon pricing solves 50% of all consumption by 2030.

Carbon Tax Center, March 21

[<http://www.carbontax.org/>, retrieved June 15, 2008]

The CTC model divides U.S. fossil-fuel burning into four sectors: electricity, which accounts for 40% of nationwide CO₂ emissions; gasoline, accounting for 21%; jet fuel (4%), and other (35%). We apply separate long-run demand price-elasticities – 70% for electricity, 40% for gasoline, 60% for jet fuel, and 50% for other – with further assumptions for supply-side substitution of carbon as well. (All assumptions are detailed in the spreadsheet; users may input their own.) As currently configured, the Hybrid Carbon Tax Model assumes a "10/10 hybrid carbon tax" – \$10 per ton of carbon dioxide (equivalent to roughly \$37 per ton of carbon) plus 10 cents per gallon of gasoline and jet fuel, ramped up every year for 20 years. The model, written in spreadsheet form, may be easily modified by changing a few settings in the Summary worksheet, to correspond to other tax combinations. These may include no combination, i.e., a straight carbon tax (or, for that matter, a tax on gasoline alone). The model indicates that the 10/10 hybrid carbon tax just outlined, ramped up indefinitely at the annual increase rates of \$10 per ton of carbon dioxide and 10 cents per gallon of gasoline and jet fuel would, by 2030, result in U.S. CO₂ emissions falling 50% below current projections for 2030, and 30% below current (2007) levels. U.S. oil consumption would be almost 40% less than projected 2030 levels, and 14% less than current usage.



Warming causes water wars in the Middle East

Lean 2005

[Geoffrey, 2/6/2005, The Independent on Sunday, Pg. 10,11, SPECIAL REPORT: GLOBAL WARMING: APOCALYPSE NOW: HOW MANKIND IS SLEEPWALKING TO THE END OF THE EARTH; FLOODS, STORMS AND DROUGHTS. MELTING ARCTIC ICE, SHRINKING GLACIERS]

What could happen? Wars break out over diminishing water resources as populations grow and rains fail. How would this come about? Over 25 per cent more people than at present are expected to live in countries where water is scarce in the future, and global warming will make it worse. How likely is it? Former UN chief Boutros Boutros-Ghali has long said that the next Middle East war will be fought for water, not oil.



1NC

Because this resolution brings into question whether the United States should price carbon or not, the value for this debate should be governmental obligations

Governments' obligations are to provide the most good to the greatest number of their citizens possible.

Goodin, Robert. Fellow of philosophy at Australian National University, **1990** (The Utilitarian Response)

Whatever its shortcomings as a personal moral code, there is much to be said for utilitarianism as a 'public philosophy'. Utilitarianism of some form or another is incumbent upon public policy-makers because of the peculiar tasks they face and because of the peculiar instruments available to them for pursuing those tasks. Given those substantially inalterable facts about the enterprise in which they are engaged, public policy-makers have little choice but to batch-process cases, acting through rules, principles, and policies, which are broadly general in form and substantially uniform in application. When looking for general, uniform public rules, principles, and policies, the premium is upon doing the right thing on average and in standard cases. In that context, utilitarianism seems to be a highly attractive proposition.

And, the standard we should use in this debate to measure governmental obligation is maximizing equality of wellbeing.

According to Maiese:

Without consideration for equality in human wellbeing, those out of power become dehumanized. Dehumanization is a prerequisite to violence - it makes conflict, human rights violations and genocide inevitable - it's empirically proven.

Maiese 03 [Michelle, Graduate Student of Philosophy at the University of Colorado, Boulder; Research Staff at the Conflict Research Consortium; "Dehumanization," <http://www.beyondintractability.org/essay/dehumanization/>]

While deindividuation and the formation of enemy images are very common, they form a dangerous process that becomes especially damaging when it reaches the level of dehumanization. Once certain groups are stigmatized as evil, morally inferior, and not fully human, the persecution of those groups becomes more psychologically acceptable. Restraints against aggression and violence begin to disappear. Not surprisingly, dehumanization increases the likelihood of violence and may cause a conflict to escalate out of control. Once a violence break over has occurred, it may seem even more acceptable for people to do things that they would have regarded as morally unthinkable before. Parties may come to believe that destruction of the other side is necessary, and pursue an overwhelming victory that will cause one's opponent to simply disappear. This sort of into-the-sea framing can cause lasting damage to relationships between the conflicting parties, making it more difficult to solve their underlying problems and leading to the loss of more innocent lives. Indeed, dehumanization often paves the way for human rights violations, war crimes, and genocide. For example, in WWII, the dehumanization of the Jews ultimately led to the destruction of millions of people. [9] Similar atrocities have occurred in Rwanda, Cambodia, and the former Yugoslavia.

Contention 1 - CO2 Emissions protect us from Warming



The greenhouse effect is a lie, CO2 ends up cooling

Stark, 2014 - Australian Climate Science Coalition, PhD in marine science from the University of Miami in 1964, and expert at The Heartland Institute (Walter, "Why Climate Change Doesn't Scare Me", Quadrant, 2014, <http://quadrant.org.au/opinion/doomed-planet/2014/06/climate-change-doesnt-scare/>)/VIVIENNE

To call the warming induced by CO2 a greenhouse effect is highly misleading. A greenhouse affects its warming by enclosing the air inside with walls and a roof. Without a roof only very limited warming is possible before convection wafts away heated air like a hot air balloon. A greenhouse with no roof or walls, where the warm air is free to blow away with the wind or drift into the sky is something only an academic could imagine. (Note to climate experts: a greenhouse without a roof does not work.) A better analogy for the effect of increased atmospheric CO2 might be that presented by an absorption refrigerator - an old-fashioned gas or kerosene fridge. In such systems a heat source is used to drive an evaporative cooling cycle, much as the warm surface temperature of the planet drives convection, augmented by the evaporation/condensation cycle, to cool the lower troposphere and transport heat to greater altitudes where reduced gas density permits it to radiate away. The so called greenhouse effect is limited. No heat is being "trapped" by a greenhouse with no walls or roof. The real world effect of more CO2 is much more like that of a shade house equipped with evaporative cooling.

Negative feedbacks from CO2 emissions check back warming

Stark, 2014 - Australian Climate Science Coalition, PhD in marine science from the University of Miami in 1964, and expert at The Heartland Institute (Walter, "Why Climate Change Doesn't Scare Me", Quadrant, 2014, <http://quadrant.org.au/opinion/doomed-planet/2014/06/climate-change-doesnt-scare/>)/VIVIENNE

Despite the increasingly shrill insistence by climate alarmists that we face an imminent catastrophe, reason and evidence continue to indicate otherwise. Both the theoretical understanding of anthropogenic global warming (a.k.a. climate change) and the empirical evidence remain highly uncertain, tainted by dubious claims and manipulations. While the basic physics of infrared heat absorption by CO2 is well established, both theoretical understanding and real world evidence strongly indicate the effect of increased CO in the complex dynamics of the global climate system has been greatly exaggerated. The amount of back-radiated infrared energy from the planet's surface is limited and is not increased by more CO2 in the air above. Although a small amount of CO2 in the air results in significant warming, this effect is quickly saturated. At pre-industrial levels of CO2 the portion of the IR spectrum in the absorption bands of CO2 was already 99.9% absorbed within a few tens of metres of the surface. Although doubling CO2 must halve the distance over which such absorption occurs, any increased heating near the surface is continuously distributed into a much larger volume of the atmosphere by wind, convection and turbulence. How close to the surface initial warming occurs has minimal effect on the total amount of heat energy being absorbed or on the temperature of the much larger volume of atmosphere into which it is being mixed. However, concentrating the initial heating nearer to the surface must also strengthen both convection and evaporation which, in turn, increases transport of heat away from the surface to higher in the troposphere, where the increased evaporation then results in increased condensation. In this process the latent heat of evaporation absorbed from the surface is released high in the atmosphere, where the thinner gases permit it to radiate into space. At the same time more cloud cover and precipitation also results, acting as a further negative feedback to cool the surface.

Contention 2 - Federal Policies On Emissions Hurt the Economy

Efforts to reduce global warming hurt the economy - jobs and manufacturing

Barrasso and Heitkamp, 2014 - John is junior senator from Wyoming and Heidi is a member of the North Dakota Democratic-Nonpartisan League Party and is the junior senator from North Dakota (John and Heidi, "The New Anti-Coal Rules Will



Cut Jobs and Hurt the Economy,” Wall Street Journal, 2014, <http://online.wsj.com/articles/the-new-anti-coal-rules-will-cut-jobs-and-hurt-the-economy-1401751493>)/VIVIENNE

On Monday, the Obama administration unveiled new regulations to restrict the amount of carbon dioxide produced by existing power plants. While we agree that America needs to balance energy needs with environmental concerns, the timing of this effort could hardly be worse for the struggling U.S. economy. We learned just last week that the economy is shrinking for the first time since 2011. America's labor-force participation remains low. Millions of Americans continue to have difficulty finding good jobs. These excessive new regulations will likely force power plants to close, putting Americans out of work. The administration repeatedly promised to deliver regulatory certainty and give states "flexibility" if they meet the tough new standards. The fact is that states have to present their plans to the Environmental Protection Agency for final approval. If the EPA doesn't approve the state plan, the agency could impose its requirements on the state. The 645-page rule would give states a few options to reduce emissions. Those options are still very restrictive and will take away good jobs, increase energy costs and hurt the economy. EPA Administrator Gina McCarthy said that the agency's regulations will decrease energy costs by 8% by 2030. We remain skeptical and believe that consumers will see higher rates. Businesses, large and small, and manufacturers will have to pay much more for their electricity; these increased prices will be absorbed or passed on and will further hurt the economy. In states that already require higher portions of renewable fuels, electricity costs are on average 30% higher than in other states. Recent studies have estimated that this rule would lead to certain job losses, with one study by the U.S. Chamber of Commerce estimating that an aggressive carbon policy would eliminate hundreds of thousands of jobs by forcing coal-fired power plants to shut down. This does not even begin to address capacity and reliability issues that the administration all too often brushes aside. Coal-fired power plants will be especially hard hit, disproportionately hurting coal-producing states like Wyoming, North Dakota, Pennsylvania and Montana. When excessive Washington red tape closes a power plant or a coal mine in a small community, those jobs aren't the only ones to go. The lost revenue base hurts public schools, police and busing services for seniors who can't drive. Teachers, laborers and doctors move away, looking for a better chance somewhere else. Small businesses don't have enough customers, so they shut down—the town withers away. The pain is felt locally, but America's environmental policies must reflect the fact that carbon dioxide is produced globally. The U.S. share of carbon-dioxide emissions has been dropping for more than a decade. Meanwhile, emissions in developing countries have soared. China's have increased by 173% from 1998 to 2011. These new EPA policies will produce minimal environmental benefits unless other countries also aggressively reduce emissions, to the detriment of their economies. That is unlikely in the near term. While working together in the Senate, we have consistently supported policies that will help the nation develop energy as clean as it can, as fast as it can. As representatives of energy-producing states, we have also seen firsthand that the country and the economy cannot function without coal and other fossil fuels. The American people must be allowed to be part of this discussion. We have heard overwhelmingly from people in Wyoming and North Dakota that they don't support extreme and expensive regulations. During the president's first term, Congress rejected, on a bipartisan basis, a national energy tax. These new regulations will in effect impose a national energy tax—but without the input of Americans or their representatives. We would invite President Obama and EPA Administrator McCarthy to come out to Wyoming and back to North Dakota to see the real-world effects these policies have on jobs, families and communities. We want them to meet the people and go to the communities that will be hurt by these regulations. We also want them to see how states like ours are balancing the pristine beauty of their environment with the need for a vibrant economy. The president has challenged the world and every American to spend more and regulate more to combat climate change. We think that it's a debate worth engaging in and that the president should bring his proposal to Congress. Our constituents, at a minimum, deserve this consideration.

Contention 3 - CO2 Emissions are needed to prevent the coming ice age

The next Ice Age is coming now. Scientists now think increasing CO2 Emissions might be a good idea.

Mark Whittington 2015, Houston Science News Examiner, July 12, "Solar scientists say we need to get ready for a mini ice age in the 2030s" <http://www.examiner.com/article/solar-scientists-say-we-need-to-get-ready-for-a-mini-ice-age-the-2030s>

Some climate scientists are so worried sick about global warming that they are showing signs of psychological stress, Esquire informs us. UPI has some good news and some bad news concerning climate change on



Saturday. The good news is that global warming is not going to happen after all, at least for a long while. The bad news is that we're in for a mini-ice age starting about 2030. The culprit is an engine that affects climate far more powerful than anything humanity can devise. That engine is the sun. The sun is the source of all climate, its light and heat interacting with the complex system on Earth with its atmosphere and bodies of water. Solar scientists are predicting a 60 percent decrease in activity on the sun, which will trigger the mini-ice age. The last time this event happened cause a mini-ice age between 1645 and 1715 during which the Thames regularly froze during the winter. If the solar scientists are right, we're in for some bitter cold winters for at least a decade, perhaps more, in the middle of the 21st Century. This is a far cry from the confident predictions of climate scientists of melting ice caps, rising sea levels, storms, famines, and pestilence that they say will result from global warming. The prediction suggests that far from wanting to cut back on carbon dioxide emissions, the world community might want to consider increasing them instead. A little greenhouse effect might go a long way toward mitigating the frigid future that yet another group of scientists say is in store for us. On the other hand, the dueling predictions suggests that some caution and no little flexibility might be in order where policies related to global warming or global cooling or whatever constitutes climate change is this week.

Ice age leads to extinction—comparatively outweighs warming

Chapman, 8[Phi., Managing Director at CMW Geosciences Pty Ltd, "Sorry to ruin the fun, but an ice age cometh", The Australian, 4/23, <http://www.theaustralian.com.au/archive/news/sorry-to-ruin-the-fun-but-an-ice-age-cometh/story-e6frg73o-1111116134873>]

There is no doubt that the next little ice age would be much worse than the previous one and much more harmful than anything warming may do. There are many more people now and we have become dependent on a few temperate agricultural areas, especially in the US and Canada. Global warming would increase agricultural output, but global cooling will decrease it.¶ Millions will starve if we do nothing to prepare for it (such as planning changes in agriculture to compensate), and millions more will die from cold-related diseases.¶ There is also another possibility, remote but much more serious. The Greenland and Antarctic ice cores and other evidence show that for the past several million years, severe glaciation has almost always afflicted our planet.¶ The bleak truth is that, under normal conditions, most of North America and Europe are buried under about 1.5km of ice. This bitterly frigid climate is interrupted occasionally by brief warm interglacials, typically lasting less than 10,000 years.¶ The interglacial we have enjoyed throughout recorded human history, called the Holocene, began 11,000 years ago, so the ice is overdue. We also know that glaciation can occur quickly: the required decline in global temperature is about 12C and it can happen in 20 years.¶ The next descent into an ice age is inevitable but may not happen for another 1000 years. On the other hand, it must be noted that the cooling in 2007 was even faster than in typical glacial transitions. If it continued for 20 years, the temperature would be 14C cooler in 2027.¶ By then, most of the advanced nations would have ceased to exist, vanishing under the ice, and the rest of the world would be faced with a catastrophe beyond imagining.¶ Australia may escape total annihilation but would surely be overrun by millions of refugees. Once the glaciation starts, it will last 1000 centuries, an incomprehensible stretch of time.¶ If the ice age is coming, there is a small chance that we could prevent or at least delay the transition, if we are prepared to take action soon enough and on a large enough scale.¶



NEG Cards/A2's

Increased CO2 results in direct plant growth - empirics and studies prove

Idso et al., 2014 - Craig is a founder and chairman of the Center for the Study of Carbon Dioxide and Global Change. Since 1998, he has been the editor and chief contributor to the online magazine CO2 Science. He is the author of several books, including *The Many Benefits of Atmospheric CO2 Enrichment* (2011) and *CO2, Global Warming and Coral Reefs* (2009). He earned a Ph.D. in geography from Arizona State University (ASU), where he lectured in meteorology and was a faculty researcher in the Office of Climatology. Sherwood is president of the Center for the Study of Carbon Dioxide and Global Change. Previously he was a Research Physicist with the U.S. Department of Agriculture's Agricultural Research Service at the U.S. Water Conservation Laboratory in Phoenix, Arizona. He is the author or co-author of over 500 scientific publications including the books *Carbon Dioxide: Friend or Foe?* (1982) and *Carbon Dioxide and Global Change: Earth in Transition* (1989). He served as an Adjunct Professor in the Departments of Geology, Geography, and Botany and Microbiology at Arizona State University. He earned a Ph.D. in soil science from the University of Minnesota. Robert is a stratigrapher and marine geologist with degrees from the University of Otago (New Zealand) and University of Cambridge (England). He is the author of *Climate: The Counter Consensus* (2010) and *Taxing Air: Facts and Fallacies About Climate Change* (2013). Carter's professional service includes terms as head of the Geology Department, James Cook University, chairman of the Earth Sciences Panel of the Australian Research Council, chairman of the national Marine Science and Technologies Committee, and director of the Australian Office of the Ocean Drilling Program. He is currently an Emeritus Fellow of the Institute of Public Affairs (Melbourne). Fred is one of the most distinguished atmospheric physicists in the U.S. He established and served as the first director of the U.S. Weather Satellite Service, now part of the National Oceanic and Atmospheric Administration (NOAA), and earned a U.S. Department of Commerce Gold Medal Award for his technical leadership. He is coauthor, with Dennis T. Avery, of *Unstoppable Global Warming Every 1,500 Years* (2007, second ed. 2008) and many other books. Dr. Singer served as professor of environmental sciences at the University of Virginia, Charlottesville, VA (1971-94), and is founder and chairman of the nonprofit Science and Environmental Policy Project. He earned a Ph.D. in physics from Princeton University. (Craig D., Sherwood B. Idso, Robert M. Carter, and S. Fred Singer, "Climate Change Reconsidered II: Biological Impacts", Nongovernmental International Panel on Climate Change, <http://nipccreport.org/reports/ccr2b/pdf/Chapter-1-CO2-Plants-and-Soils.pdf>)/VIVIENNE

Perhaps the best-known consequence of an increase in the air's CO2 content is its stimulation of plant productivity (dry matter content or biomass). This growth enhancement occurs because carbon dioxide is the primary raw material utilized by plants to produce the organic matter out of which they construct their tissues. Consequently, the more CO2 there is in the air, the bigger and better plants grow. Table 1.1.1 in Appendix 3 reports the results of hundreds of peer-reviewed scientific studies indicating the biomass growth response of plants to a standardized 300 ppm increase in atmospheric CO2 concentration. Plants are listed by common and/or scientific names, followed by the number of experimental studies conducted on each plant, the mean biomass response to a 300 ppm increase in the air's CO2 content, and the standard error of that mean. Whenever the CO2 increase for a given study was not exactly 300 ppm, a linear adjustment was computed. For example, if the CO2 increase was 350 ppm and the growth response was a 60% enhancement, the adjusted 300 ppm CO2 growth response was calculated as $(300/350) \times 60\% = 51\%$. The data in the table are printed by permission of the Center for the Study of Carbon Dioxide and Global Change and were taken from its Plant Growth database on 1 January 2014. The table summarizes CO2 enrichment results from 3,586 separate experimental conditions conducted on 549 plant species. The responses are overwhelmingly positive. New data are added to the database at approximately weekly intervals and can be accessed free of charge at the center's website at http://www.co2science.org/data/plant_growth/dry/dry_subject.php. This online database also archives information pertaining to the experimental conditions under which each plant growth experiment was conducted, as well as the complete reference to the journal article from which the experimental results were obtained. The center's online database also lists percent increases in plant biomass for 600 and/or 900 ppm increases in the air's CO2 concentration. Table 1.1.2 in Appendix 4 reports the results of peer-reviewed scientific studies measuring the photosynthetic growth response of plants to a 300 ppm increase in atmospheric CO2 concentration. Plants are listed by common and/or scientific names, followed by the number of experimental studies conducted on each plant, the mean photosynthetic response to a 300 ppm increase in the air's CO2 content, and the standard error of that mean. Whenever the CO2 increase for a given study was not exactly 300 ppm, a linear adjustment was computed. For example, if the CO2 increase was 350 ppm and the growth response was a 60% enhancement, the adjusted 300 ppm CO2 growth response was calculated as $(300/350) \times 60\% = 51\%$. The data in the table appear by permission of the Center for the Study of Carbon Dioxide and Global Change and were taken from its Plant



Growth database on 1 January 2014. In all, the table summarizes CO₂ enrichment results from 2,094 separate experimental conditions conducted on 472 plant species. The responses are overwhelmingly positive. New data are added to the database at approximately weekly intervals and can be accessed free of charge at the center's website at http://www.co2science.org/data/plant_growth/dry/dry_subject.php. This online database also archives information pertaining to the experimental conditions under which each plant growth experiment was conducted, as well as the complete reference to the journal article from which the experimental results were obtained. The center's online database also lists percent increases in plant photosynthetic rate for 600 and/or 900 ppm increases in the air's CO₂ concentration. One of the more commonly voiced concerns about atmospheric CO₂ enrichment is whether the plant growth enhancements observed in short-term laboratory and field studies will persist over the lifespan of plants. The subsections below investigate this topic with respect to both woody and non-woody plants, leaving no doubt as to the sustained response of plants to elevated atmospheric CO₂.

1.1.3.1 Non-Woody Plants In Switzerland, Niklaus et al. (2001) exposed a species-rich but nutrient-poor and water-limited, calcareous grassland dominated by *Bromus erectus* (which accounted for approximately half of the ecosystem's aboveground vegetative biomass) to atmospheric CO₂ concentrations of approximately 360 and 600 ppm for six years, using screen-aided CO₂ control (SACC) technology. CO₂-induced increases in biomass production in years one through six of the experiment were, respectively, 5%, 20%, 22%, 27%, 31%, and 18%, for an average of 23.6% over the last five years of the study (Niklaus and Körner, 2004). This biomass increase ultimately increased carbon stocks in plant shoots and roots by 17 and 24%, respectively, and enhanced carbon stocks in vegetative litter by 34%. The net effect of these increases was an initial air-to-soil carbon flux of 210 g C m⁻² year⁻¹. After six years of treatment, however, the CO₂-enriched soils held only about 44% of the carbon expected from this influx rate, due to the low soil residence time of the newly input carbon. Nevertheless, the study showed atmospheric CO₂ enrichment can in fact enhance plant growth and carbon sequestration in low-nutrient and water-limited soils. In Italy, Bettarini et al. (1998) measured the stomatal densities and conductances of the leaves of 17 species of plants growing in the vicinity of a natural CO₂-emitting spring that has produced twice-ambient atmospheric CO₂ concentrations for at least two centuries, while making similar measurements on plants of the same species located further from the spring, where normal CO₂ concentrations prevail. The elevated CO₂ decreased leaf stomatal conductances in all but one of the species by 19 to 73%. These reductions, however, were not accompanied by decreases in stomatal density, which remained unaffected by long-term atmospheric CO₂ enrichment in all but three species. Consequently, life-long exposure to elevated CO₂ reduced plant water use primarily by controlling leaf stomatal function, not by changing leaf anatomical features (i.e., the number of stomata per unit leaf area). These findings are encouraging, but it has been suggested they cannot persist indefinitely in all situations. The productivity of Earth's temperate grasslands, for example, is often limited by the availability of soil nitrogen (Vitousek and Howarth, 1991), and both empirical and modeling studies have suggested the magnitude and duration of grassland growth responses to rising levels of atmospheric CO₂ may be constrained by inadequate supplies of soil nitrogen (Rastetter et al., 1997; Luo and Reynolds, 1999; Thornley and Cannell, 2000). In light of this mix of real-world observations and theoretical calculations, it would seem only natural to hypothesize, as Richter et al. (2003) do, "that increased below-ground translocation of photo-assimilates at elevated pCO₂ would lead to an increase in immobilization of N due to an excess supply of energy to the roots and rhizosphere," and that this phenomenon would lead ultimately to a reduction in the size of the growth-promoting effect of elevated atmospheric CO₂ that is manifest in short-term CO₂ enrichment experiments and at the start of long-term studies. To test this hypothesis, Richter et al. (2003) measured gross rates of N mineralization, NH₄ + consumption, and N immobilization in soils on which monocultures of *Lolium perenne* and *Trifolium repens* had been exposed to ambient (360 ppm) and elevated (600 ppm) concentrations of atmospheric CO₂ at high and low rates of soil nitrogen addition for seven years in the Swiss free-air CO₂ enrichment (FACE) study conducted near Zurich. After seven years of treatment, they report, "gross mineralization, NH₄ + consumption and N immobilization in both the *L. perenne* and the *T. repens* swards did not show significant differences." In addition, the size of the microbial N pool and immobilization of applied mineral 15N were not significantly affected by the elevated CO₂. Richter et al. note the results of their study "did not support the initial hypothesis and indicate that below-ground turnover of N, as well as N availability, measured in short-term experiments are not strongly affected by long-term exposure to elevated CO₂." They conclude "differences in plant N demand and not changes in soil N mineralization/immobilization are the driving factors for N dynamics in these meadow grassland systems." Thus, as also found in the woody plant studies of Finzi and Schlesinger (2003) and Schafer et al. (2003) conducted in the Duke Forest FACE experiment, Richter et al.'s work provides no evidence the growth responses of Earth's grasslands to atmospheric CO₂ enrichment will ever be significantly reduced from what is suggested by moderate-term studies of a few to several years' duration. In a study of the same *L. perenne* and *T. repens*



ecosystems that helps to explain some of these observations, Gamper et al. (2004) analyzed the effects of elevated CO₂ and N fertilization (14 vs. 56 g N m⁻²) on arbuscular mycorrhizal fungi. They report, “at elevated CO₂ and under both N treatments, AMF root colonization of both host plant species was increased” and “colonization levels of all three measured intraradical AMF structures (hyphae, arbuscules and vesicles) tended to be higher.” In addition, they found an increase in non-AMF root colonization under elevated CO₂. As a result, they “hypothesize that AMF provide non-P-nutritional benefits under the phosphorus-rich soil conditions of our field experiment” and these benefits “may include improved N nutrition and increased protection against pathogens and/or herbivores.” In another long-term study conducted in Switzerland, Ainsworth et al. (2003b) analyzed data from what has become the longest-running FACE experiment ever conducted anywhere in the world. The impetus for their analysis was the speculation that, in their words, “elevated CO₂ may partition resources away from leaves and, through increased production, sequester nutrients into organic matter causing deficiencies which indirectly cause decreased photosynthetic capacity.” In this regard, they cite the theoretical study of these considerations conducted by Luo and Reynolds (1999), who “predicted that the initial stimulation of photosynthetic production in grasslands would be lost within nine years of a step increase in CO₂, as imposed in FACE experiments.” With real-world data obtained over nearly a decade of experimentation with white clover (*Trifolium repens*) grown in monoculture in the Swiss FACE array, Ainsworth et al. (2003b) characterized the photosynthetic responses of the plants to the extra 240 ppm of CO₂ delivered to them in the spring and autumn of the eighth year of the experiment. They determined there was no acclimation or down-regulation of photosynthetic capacity in the spring of the year. In the autumn, however, there was a down-regulation of approximately 20%, but it occurred “late in the growing season, when the 24-hour mean temperature had dropped below 10° C, and nightly frosts were occurring,” under which conditions “shoot growth is limited and the sink for carbohydrate is small, and acclimation of photosynthesis to elevated CO₂ would be expected.” In spite of that acclimation and the stress of those cold conditions, the average photosynthetic rate of the CO₂-enriched plants at that time of year was still 37% greater than the ambient-treatment plants. Therefore, the five scientists conclude their results “do not support the prediction that the response of grassland species to elevated CO₂ will be short-lived as the demand for nutrients increases.” This conclusion clearly contradicts the claim of Luo and Reynolds and others’ similar claims, for as Ainsworth et al. reiterate in the concluding sentence of their paper, “contrary to the belief that the response of grassland species to elevated CO₂ will be short-lived, stimulation of photosynthesis in *T. repens* remained after eight years of exposure to elevated CO₂.” In another report on this longest FACE study ever conducted on a grassland species, Ainsworth et al. (2003a) note “photosynthesis is commonly stimulated in grasslands with experimental increases in atmospheric CO₂ concentration, a physiological response that could significantly alter the future carbon cycle if it persists in the long term.” However, they also note “an acclimation of photosynthetic capacity suggested by theoretical models and short-term experiments could completely remove this effect of CO₂.” This suggests, in their words, “perennial systems will respond to elevated CO₂ in the short term, but the response for grasslands will be short-lived (Roumet et al., 2000),” and they cite Luo and Reynolds (1999) as suggesting an effective CO₂-induced stimulatory period of less than 10 years for both high- and low-productivity grasslands. The only way to resolve the issue is to conduct a long-term experiment—such as the sour orange tree study of Idso and Kimball (2001)—which is exactly what the eight-member Ainsworth et al. (2003a) team of American, British, Italian, and Swiss scientists did in its ten-year study of perennial ryegrass (*Lolium perenne*). The study was conducted in Switzerland within three replicate blocks of two 18-m-diameter FACE rings maintained at either 360 or 600 ppm CO₂ throughout each growing season of the entire 10-year period. The experimental plots, established in 1993 on a field of perennial ryegrass planted in August 1992, were further subdivided into low and high nitrogen fertilization treatments, and the plants grown within them were periodically harvested several times a year. In addition, the authors write, “more than 3,000 measurements characterized the response of leaf photosynthesis and stomatal conductance to elevated CO₂ across each growing season for the duration of the experiment.” Ainsworth et al. (2003a) report, “over the 10 years as a whole, growth at elevated CO₂ resulted in a 43% higher rate of light-saturated leaf photosynthesis and a 36% increase in daily integral of leaf CO₂ uptake.” The 36% increase in daily CO₂ uptake was, in their words, “almost identical to the 38% increase seen on the first day of measurements in August 1993 and the 39% stimulation on the last day of measurements in May 2002.” The researchers also reported a seasonal trend in the CO₂-induced increase in the daily integral of CO₂ fixation, which ranged from 25% in the spring to 41% in the summer and 48% in the fall. The scientists say this finding “is consistent with theoretical expectation, where because of the differing sensitivities of Rubisco oxygenase and carboxylase activity, the proportionate stimulation of photosynthesis by a given increase in CO₂ will rise with temperature (Long, 1991).” This phenomenon has also been observed in a number of other plants. Ainsworth et al. (2003a) additionally note “the percentage increase in photosynthetic



carbon uptake in the first 20 days following a harvest (45%) was nearly double the percentage increase later in the regrowth cycle (23%).” This finding indicates CO₂-induced growth stimulation is greatest when the plant source:sink ratio is small; i.e., when there are few photosynthesizing leaves and many photosynthate-storing roots, so the CO₂-induced enhancement of photosynthesis need not immediately decline for lack of a sufficient repository to deposit the fruits of its labors, so to speak. Summing up, the international team of scientists says the CO₂-induced photosynthetic stimulation “was maximal following harvest, at the warmest times of year and with a high supply of nitrogen.” They concluded, “this open-air field experiment provides no support for the prediction that stimulation of photosynthesis under elevated CO₂ is a transient phenomenon,” or as they phrase it in the abstract of their paper, “in contrast with theoretical expectations and the results of shorter duration experiments, the present results provide no [evidence of] significant change in photosynthetic stimulation across a 10-year period, nor greater acclimation ... in the latter years in either nitrogen treatment.” The ultimate plant response is biomass production, which was studied in the same experiment by Schneider et al. (2004), who state, “in 1993, the CO₂ response of harvested biomass was 7.2%, increasing to 32% in 2002.” At low N, they report the CO₂ response “varied annually.” Nevertheless, it too exhibited a slowly increasing (though non-significant) trend, suggesting, given enough time, it might have gained statistical significance as well.



Increased CO₂ increases plant biomass and allows for carbon sequestration - climate policies contribute to air pollution and deforestation

Ballonoff, 14 - Economist, a former utility rate regulator in Kansas and Illinois, writer for the Cato Institute (Paul, "A Fresh Look at Climate Change", Winter, "AN INTERDISCIPLINARY JOURNAL OF PUBLIC POLICY ANALYSIS", The Cato Journal, Volume 34, Number 1, <http://object.cato.org/sites/cato.org/files/serials/files/cato-journal/2014/2/cato34n1issuelow.pdf#page=119>)/VIVIENNE

Climate science, and especially understanding the interaction of human activity with climate, remains one of the key scientific challenges of our time. Humans have profoundly affected vast swaths of Australia, Eurasia, and the Americas, at least in the immediate term, by agricultural and other practices. But understanding long-term effects is not so easily guided by seemingly simple projections from short-term observations. For example, it is widely accepted that in the 50,000 years that humans have occupied the continent of Australia, the flora and fauna have been changed profoundly (Gammage 2012). Yet, even with a century of very detailed research, it is not known for certain that the seemingly obvious inference that use of fire for clearing land over that long period has had any longterm effect on the natural climate of Australia (Smith 2013, Mulvaney and Kamminga 1999: 60-62). It is therefore not speculation that humans can have large-scale effects on the environment. It is critical we take the risks seriously. Global climate has a profound effect on human viability. Geologically, we are at the warm cusp of an interglacial period. The period of human recorded history has occurred within a period of warming generally. Glaciation historically has occurred rather rapidly on geological time scales. The risk of severe cooling does not seem imminent, nor does the risk of severe human-induced warming. If we can find scientifically demonstrated ways to regulate the global thermostat, we certainly want to know what those might be. The extravagant claims made by many in the climate change community have not advanced that effort, and may have contributed a widening mistrust of use of science for determining policy. Real science is not simply the application of ad hoc models to predict pending disasters; it also compares the results of predictions to actual events. The technical community that has produced false predictions of global warming, by failing to compare predictions to subsequent actual events, adds an unfortunate chapter to a long history of abuse of the appearance of science for political purposes (Michaels 1999a, 1999b). The empirically demonstrated evidence on water use by plants in an enhanced CO₂ environment is the opposite of the commonly claimed effect from models that look only at assumed increased heating due to CO₂ increases. Empirically, CO₂ has recently been associated with warming only until increased green growth set in. That increased growth however continues so long as the extra CO₂ is present. Despite reluctant rhetoric, other climate modelers recently studying the process have also created models that show higher CO₂ concentration increases biomass. (Cox et al. 2013, Huntingford et al. 2013). But like the IPCC, many such authors seem to regard the model, not the reality against which compared, as the primary evidence. That attitude is unique in the physical or biological sciences, where reliability of prediction is judged by correspondence to empirical evidence. Reflecting a similar error, much climate policy relies heavily on projecting assumed trends. NASA, for example, has recently displayed the results of an entire set of models that assume continued warming and then predict its effects.² But the prediction is meaningful only if the future warming exists. Trend data are only reliable for forecasts if the underlying conditions assumed remain constant and are a relatively complete description of the underlying real processes. Climate trend models have not fully accounted for the ability of plants to use water more efficiently at higher CO₂ concentrations and have underrated the capacity for aerial fertilization to sharply improve sequestration via plant growth. Had they done so, like the 1991 ARS study or the 2012 Australian analysis, they may have predicted temperature and other effects more accurately. The misuse of modeling as a surrogate for science, which superficially allows advocacy to claim science without looking at actual evidence, has not been unique to climate warming. The new ice age foreseen in the 1950s to early 1970s did not visit us. The U.S. National Center for Atmospheric Research, one of the more prominent prophets of the new ice age, later switched to prophecy of global warming—presumably for political rather than scientific purposes. The forecasted population explosion and exhaustion of physical resources did not carry the earth past a presumed inherent carrying capacity by the early 1990s, foretold in well-known studies led by the Club of Rome and the American Association for Advancement of Science (Hardin, Lyons, and Edelson 1973; Meadows, Singer, and Perlman 1973; Meadows et al. 1974), and which were criticized even at the time (Cole et al. 1973). A 2004 update (Meadows et al. 2004) to the forecast changed the dates but not the methods, and did not improve the forecast. Instead of explosive growth, world population growth slowed, itself unpredicted by all but one theory (Ballonoff 1998). Moreover, as mineral prices were falling in real terms, efficiency of use increased, and absolute remaining known resources have generally grown in



both relative and absolute terms. This is especially true for energy resources: known reserves have grown, despite that total use has far outpaced forecasts, and real price (as opposed to nominal dollar price) has fallen, not exploded to the predicted heights forecasted by the U.S. Department of Energy and others (Ballonoff and Moss 1991, Ballonoff 1997). The technology-driven mechanisms of expanding reserves also characterize the current expansion of energy reserves through fracking. What all of these examples show is that models alone, without comparison of their results to actual evidence and without embodying what is known from experimentally demonstrated behavior of nature, are not science, and may be extremely misleading foundations on which to base policy. This article has focused on the empirical effects of climate policy related to effects of atmospheric CO₂ concentration on energy development policy, especially for electricity. Some policies are not affected by the evidence on CO₂ concentration. Energy efficiency remains a compelling goal in all climate scenarios because it leads to the most effective use of all energy capital investment and is readily achieved by normal market forces. Renewable generation remains a desired option for certain purposes of energy security, as well as for aspects of grid supply (assuming the grids are competently operated, reliable, and paid for), for potentially reducing grid losses, and as a substitute for other fuels. Such purposes, as well as programs such as “sustainable landscapes” that encourage preservation and expansion of green areas, seem justified by the demonstrated empirical effects of CO₂. But many of the documented effects of current climate policies show a counterproductive effect on development. Efforts to reduce CO₂ emissions by subsidizing biofuels, including subsidizing wood itself as an electricity generation fuel, appear instead to be the principal cause of deforestation. Policies to avoid carbon fuels may be inhibiting development of more economically efficient central grids and degrading the operation of existing grids, thus making more difficult the task of serving the underserved with reliable and low-cost electricity. That result, in turn, paradoxically causes expanded use of hydrocarbons in the form of kerosene, with its own soot and air pollution effects, as kerosene is available where grids are not. Forest products are also harvested to substitute for unavailable reliable electric power and, as a result, contribute to deforestation. The empirically demonstrated ability of global greening to absorb greatly enhanced CO₂ concentrations and mitigate warming would seem to make policies to avoid carbon fuels in developing countries unnecessary. The demonstrated natural sequester of CO₂ in plants as atmospheric CO₂ concentration increases seems to obviate the need for foreign development capital projects to artificially sequester CO₂. In sum, the rather extensive funds dedicated to such uses by multilateral and national sources of development capital would be more effective in meeting development goals if used to increase least-cost reliable supply. It is apparent that the demonstrated science of the direct and indirect effects due to increased CO₂ concentration is rather different from that expected by many. Past climate policy has very often been based principally on models that have not been borne out by experience. Models alone are not science; models merely reflect the assumptions embedded in them. In climate models, and climate policy generally, those assumptions have apparently not reflected demonstrated evidence. Climate policy should reflect what experimental and empirical evidence show to be true.



Sequestration solves climate change

USDA, 13 - United States Department of Agriculture ("Carbon Sequestration", USDA, May 14, <http://www.fs.fed.us/ecosystems-services/carbon.shtml>)//VP

Interest in terrestrial carbon sequestration has increased in an effort to explore opportunities for climate change mitigation. Carbon sequestration is the process by which atmospheric carbon dioxide is taken up by trees, grasses, and other plants through photosynthesis and stored as carbon in biomass (trunks, branches, foliage, and roots) and soils. The sink of carbon sequestration in forests and wood products helps to offset sources of carbon dioxide to the atmosphere, such as deforestation, forest fires, and fossil fuel emissions. Sustainable forestry practices can increase the ability of forests to sequester atmospheric carbon while enhancing other ecosystem services, such as improved soil and water quality. Planting new trees and improving forest health through thinning and prescribed burning are some of the ways to increase forest carbon in the long run. Harvesting and regenerating forests can also result in net carbon sequestration in wood products and new forest growth. In response to government, business, and individual commitments to reduce carbon dioxide emissions, carbon is now a priced environmental commodity in the global marketplace. The United States carbon market is in its formative stages. States and regions are developing climate change strategies and policy for reducing carbon dioxide emissions, and mandatory markets are forming at the regional and state levels. The Voluntary Reporting of Greenhouse Gases Program, established by Section 1605(b) of the Energy Policy Act of 1992, provides a means for organizations and individuals - including forest landowners and other land managers - to record their baseline emissions and emission reductions.



Greenhouse gases key to staving off the next ice age - we should not alter human progress over false warming claims

Idso 1999 [Sherwood, president of the Center for the Study of Carbon Dioxide and Global Change; Kieth, ounder, former president and current chairman of the board of the Center for the Study of Carbon Dioxide and Global Change; Keith, MS from university of Arizona major in Agronomy and Plant Genetics, "Is interplanetary dust related to ice ages?", http://www.co2science.org/subject/questions/1999/interplanet_dust.php]

There is indeed a general consensus that the cyclical glaciations of the past million years [Climate History (Overview - The Last 2,000,000 Years)] are driven by phenomena related to the receipt of solar radiation at the surface of the earth, and that cyclical variations in the accretion of interplanetary dust may play a role in this regard.¶ Standard Milankovitch (1920, 1941) theory, which relates changes in insolation to changes in the eccentricity of earth's orbit, has been the dominant force in studies of this subject for the past few decades. The past few years, however, have seen a challenge arise in the form of a number of pesky problems that continue to gnaw at it. These deficiencies have been described by Muller and MacDonald (1995, 1997), who first elucidated the potential interactive role of cyclical variations in the inclination of the earth's orbit relative to the invariable plane of the solar system, whereby meteoroids and dust concentrated in the invariable plane are accreted at greater rates when the earth passes through the invariable plane. Although they have not been able to calculate quantitatively the effects of various mechanisms of accretion on climate, they claim that their hypothesis resolves a number of problems associated with the Milankovitch theory.¶ As to whether we should be "pouring CO2 and methane into the atmosphere" in an effort to forestall the next expected glaciation, which is not that far distant in terms of geologic time, you could perhaps make a good case for such a program. It would seem to be no more farfetched than the current designs of many governments to do just the opposite and dramatically reduce CO2 emissions to stave off predicted global warming. With apparent reasons to pull strongly in both directions, perhaps the course of wisdom would be to not unduly meddle in the normal progression of human affairs.



Increased atmospheric CO₂ is key to agricultural production and water efficiency

Ballonoff, 14 - Economist, a former utility rate regulator in Kansas and Illinois, writer for the Cato Institute (Paul, "A Fresh Look at Climate Change", Winter, "AN INTERDISCIPLINARY JOURNAL OF PUBLIC POLICY ANALYSIS", The Cato Journal, Volume 34, Number 1, <http://object.cato.org/sites/cato.org/files/serials/files/cato-journal/2014/2/cato34n1issuelow.pdf#page=119>)// VIVIENNE

The foundation of the modern climate change discussion is the accurate observation that human activity has significantly increased the atmospheric concentration of CO₂, and that such activity is continuing (Tans 2009). Increased CO₂ concentration, especially when amplified by predicted feedback effects thus also is assumed to predict increasing global average atmospheric temperature. Depending on the degree of warming expected, other serious and mainly undesired effects are predicted. As The Economist (2013a) observed, the average global temperature did rise on average over the previous century. Following a 25-year cooling trend post-World War II, temperatures increased at an especially strong rate in the quarter century ending in 1997. The trend of that warming period, the correlation with increased CO₂, and the fact of human activity causing that CO₂ increase apparently supported use of projection models extending that trend to future years. Such projections were the basis for the UN's 1997 IPCC analysis on which much current policy is based. It is thus at least ironic that 1997 was also the last year in which such measured global average temperature increase took place. One of the key features of the IPCC forecast, and greenhouse effect forecasts generally, is the expected feedback loops. One of those is that the presumed drier and hotter conditions on the ground would cause expanded desertification and deforestation. A distinct kind of greenhouse effect is also predicted from increased CO₂ concentration—namely, the aerial fertilization effect, which is that plants grow better in an atmosphere of higher CO₂. Many analysts, such as the IPCC, clearly thought the greater effect would be from heating, not plant growth. One must assume this was an intentional judgment, as the IPCC was aware of the CO₂ aerial fertilization effect from its 1995 Second Assessment Report, which contained empirical evidence of increased greening in enhanced CO₂ environments (Reilly 2002: 19). In contrast, climate analysts such as those with the Cato Center for the Study of Science have argued since 1999 that atmospheric temperature is much less sensitive to increased concentration of CO₂ (Michaels 1999b). While in fact heating has not occurred as the IPCC forecasted, greatly increased global biomass is indeed demonstrated. Well documented evidence shows that concurrently with the increased CO₂ levels, extensive, large, and continuing increase in biomass is taking place globally—reducing deserts, turning grasslands to savannas, savannas to forests, and expanding existing forests (Idso 2012). That survey covered 400 peer-reviewed empirical studies, many of which included surveys of dozens to hundreds of sources. Comprehensive study of global and regional relative greening and browning using NOAA data showed that shorter-term trends in specific locations may reflect either greening or browning, and also noted that the rapid pace of greening of the Sahel is due in part to the end of the drought in that region. Nevertheless, in nearly all regions and globally, the overall effect in recent decades is decidedly toward greening (de Jong et al. 2012). This result is also the opposite of what the IPCC expected. Global greening in response to increased CO₂ concentrations was clearly predicted by a controlled experiment of the U.S. Water Conservation Laboratory conducted from 1987 through 2005 (Idso 1991).¹ In that study, half of a group of genetically identical trees were grown in natural conditions and the other half in the same conditions but in an atmosphere of enhanced CO₂ concentration. By 1991 the Agricultural Research Service (ARS) reported that the trees in the enhanced CO₂ environment contained more than 2.8 times more sequestered carbon than the natural environment trees (i.e., were 2.8 times larger). By 2005, when the experiment was ended, the total additional growth of the enhanced CO₂ trees was 85 percent more than that of the natural-condition trees, both in woody mass and in fruit. One reason for expanded growth even into dry environments is a seldom remarked propensity that CO₂ induced growth due to aerial fertilization also greatly increases a plant's efficiency of use of water. The ARS further documented this effect in a 2011 study, citing the extensive literature demonstrating that enhanced CO₂ environments "impact growth through improved plant water relations" (Prior et al. 2011). Similar results, both as to aerial fertilization effect and increased efficiency of water use, were found by the joint study of the USDA and the U.S. Department of Energy on the effects of CO₂ on agricultural



production in the United States (Reilly 2002). In that study, the effect of forecasted increased CO₂ concentration, together with the increased warming forecasted, was shown to cause up to 80 percent increases in agricultural productivity, and decreased use of water since the growth would occur faster and with more efficient water use by plants. While different crops were forecasted to respond differently, most crops were positively affected, with a range from 10 percent reduction in yield up to 80 percent increase. Even considering the complex interactions with market conditions, the overall effect was certainly found to be favorable. Using demonstrated experimental data, the 1991 ARS study also predicted effects of further or even greatly enhanced atmospheric CO₂ concentrations, such as from the expected large increase that might come (and subsequently did come and is continuing) especially from developing and newly industrializing countries. Comparing demonstrated warming to that date to the evidence, the ARS study concluded: If past is prologue to the future, how much more CO₂ induced warming is likely to occur? Very little. . . . The warming yet to be faced cannot be much more than what has already occurred. . . . A doubling of current emissions, for example, would lead to an atmospheric CO₂ content on the order of 700 ppm, which would probably be climatically acceptable, but only if the earth's forests are not decimated in the meantime [Idso 1991: 964-65].

The 1991 study noted that expanded forested areas would allow even greater atmospheric CO₂ concentrations. To assure the measured results were accurate and a reasonable basis on which to infer the effect of global-scale CO₂ concentration, the ARS also published results of eight additional distinct empirical studies of natural processes, each of which independently verified that the measured results found by direct experiment were a reasonable basis for such extrapolation (Idso 1998). The effects were recently further verified by models whose results were compared to empirical data on Australian and other arid regions. Modeling water use by plants in enhanced CO₂ environment, the study predicted the effect on plant growth in dry regions and verified the result empirically compared to actual measurements over a 30-year period (AGU 2013). The data verified the prediction both in the direction and in the quantity of effect observed: Enhanced CO₂ improves water use by plants and reduces, not increases, dry regions by making them greener. Thus, evidence to date implies that the view that global temperature is far less sensitive to CO₂ than many fear, is likely correct. Simultaneously, demonstrated experimental evidence on plant growth predicted exactly what the now extensive empirical literature shows: Enhanced CO₂ is associated with greatly increased biomass production, even in dry climates. The extent of increased CO₂ sequestration both in soil and in biomass associated with increased atmospheric concentration has also been documented (Pan et al. 2011). Those results, while not what the IPCC predicted, do not imply we should have no concerns about climate policy.



That solves extinction

Idso et al., 2014 - Craig is a founder and chairman of the Center for the Study of Carbon Dioxide and Global Change. Since 1998, he has been the editor and chief contributor to the online magazine CO₂ Science. He is the author of several books, including *The Many Benefits of Atmospheric CO₂ Enrichment* (2011) and *CO₂, Global Warming and Coral Reefs* (2009). He earned a Ph.D. in geography from Arizona State University (ASU), where he lectured in meteorology and was a faculty researcher in the Office of Climatology. Sherwood is president of the Center for the Study of Carbon Dioxide and Global Change. Previously he was a Research Physicist with the U.S. Department of Agriculture's Agricultural Research Service at the U.S. Water Conservation Laboratory in Phoenix, Arizona. He is the author or co-author of over 500 scientific publications including the books *Carbon Dioxide: Friend or Foe?* (1982) and *Carbon Dioxide and Global Change: Earth in Transition* (1989). He served as an Adjunct Professor in the Departments of Geology, Geography, and Botany and Microbiology at Arizona State University. He earned a Ph.D. in soil science from the University of Minnesota. Robert is a stratigrapher and marine geologist with degrees from the University of Otago (New Zealand) and University of Cambridge (England). He is the author of *Climate: The Counter Consensus* (2010) and *Taxing Air: Facts and Fallacies About Climate Change* (2013). Carter's professional service includes terms as head of the Geology Department, James Cook University, chairman of the Earth Sciences Panel of the Australian Research Council, chairman of the national Marine Science and Technologies Committee, and director of the Australian Office of the Ocean Drilling Program. He is currently an Emeritus Fellow of the Institute of Public Affairs (Melbourne). Fred is one of the most distinguished atmospheric physicists in the U.S. He established and served as the first director of the U.S. Weather Satellite Service, now part of the National Oceanic and Atmospheric Administration (NOAA), and earned a U.S. Department of Commerce Gold Medal Award for his technical leadership. He is coauthor, with Dennis T. Avery, of *Unstoppable Global Warming Every 1,500 Years* (2007, second ed. 2008) and many other books. Dr. Singer served as professor of environmental sciences at the University of Virginia, Charlottesville, VA (1971-94), and is founder and chairman of the nonprofit Science and Environmental Policy Project. He earned a Ph.D. in physics from Princeton University. (Craig D., Sherwood B. Idso, Robert M. Carter, and S. Fred Singer, "Climate Change Reconsidered II: Biological Impacts", Nongovernmental International Panel on Climate Change, <http://nippccreport.org/reports/ccr2b/pdf/Summary-for-Policymakers.pdf>)//VIVIENNE

Carbon dioxide is the basis of nearly all life on Earth. It is the primary raw material utilized by most plants to produce the organic matter from which they construct their tissues. Not

surprisingly, thousands of laboratory and field experiments conducted over the ability of plants to adapt to a variety of environmental stresses (Lemon, 1983). In the years since, **many other studies have been conducted on hundreds of different plant species, repeatedly confirming the growth-enhancing, water-saving, and stress-alleviating advantages that elevated atmospheric CO₂ concentrations bestow upon Earth's plants and soils** (Idso and Singer, 2009; Idso and Idso, 2011). Chapter 1 focuses on basic plant productivity responses to elevated CO₂ and includes in two appendices tabular presentations of more than 5,500 individual plant photosynthetic and biomass responses to CO₂-enriched air, finding nearly all plants experience increases in these two parameters at higher levels of CO₂. Chapter 1 also examines the effect of elevated CO₂ on ecosystems including forests, grasslands, peatlands, wetlands, and soils. **This review of the literature reveals elevated CO₂ improves the productivity of ecosystems both in plant tissues aboveground and in the soils beneath them.** The key findings of Chapter 1 are presented in Figure 4. There are two principal methods researchers utilize to ascertain how Earth's terrestrial plants will be affected by a continuation of the historical rise in the atmosphere's CO₂ concentration. One way is to grow plants in CO₂-enriched air to levels expected to be experienced in the decades and centuries to come. In the case of long-lived trees, **growth over prior decades and centuries as the CO₂ concentration has risen can be derived from studying the yearly growth rings produced over those time periods and that now comprise the living or dead trees' trunks.** The primary information sought in these studies are rates of photosynthesis and biomass production and the efficiency with which the various plants and trees utilize water. There are a host of other effects of significance, including substances produced in the growth process that impact how well it proceeds, substances deposited in the parts of agricultural crops that are harvested for human and animal consumption, and substances that determine whether insect pests find the foliage or fruit of a certain crop or tree to be to their liking. Finally, **there is the question of whether forest soils will have sufficient nitrogen to sustain the long-term CO₂-enhanced growth rates of long-lived trees.** Chapter 2 examines these and other effects of atmospheric CO₂ enrichment on plant characteristics. **Extensive research finds those effects are overwhelmingly positive.** For example, **rising CO₂ levels promote plant growth by increasing the concentrations of plant hormones that stimulate cell division, cell elongation, and protein synthesis; by enabling plants to produce more and larger flowers; by increasing the production of glomalin, an important protein created by fungi living in symbiotic association with the roots of most vascular plants; and by affecting leaf characteristics of agricultural plants that lead to higher rates and efficiencies of**



photosynthesis and growth as well as increased resistance to herbivory and pathogen attack.

The key findings of Chapter 2 are presented in Figure 5. According to IPCC, a warmer future will introduce new sources of stress on the biological world, including increases in forest fires, droughts, and extreme heat events. IPCC fails to ask whether the higher levels of atmospheric CO₂ its models also predict will aid or hinder the ability of plants to cope with these challenges.

Had it looked, IPCC would have discovered an extensive body of research showing how atmospheric CO₂ enrichment ameliorates the negative effects of a number of environmental plant stresses. The relative percentage growth enhancement produced by an increase in the air's CO₂ concentration is generally greater under stressful and resource-limited conditions than

when growing conditions are ideal. The impact of rising atmospheric CO₂ on plants under stress is the subject of Chapter 3, and key findings from that chapter appear in Figure 6. Chapter 4 analyzes how atmospheric CO₂ enrichment has boosted global food production and biospheric productivity since the beginning of the Industrial Revolution. It also reports how rising CO₂ helps plants avoid temperature-induced extinctions, which many models predict could occur if global temperatures rise significantly in the future.

Whereas IPCC projects severe food shortages in the future resulting from CO₂-induced weather-related phenomena, the preponderance of evidence suggests the many yield-enhancing benefits of rising atmospheric CO₂ will ensure enough food is grown to feed the growing population of the planet. Chapter 4 also reports on the current health of the terrestrial biosphere, analyzing the productivity of the globe as a whole followed by regional analyses on continental and sub-continental scales. According to IPCC, the productivity of the terrestrial biosphere should be declining from rising temperatures and other perceived negative climatic changes. In contrast, empirical data show it to be increasing, in large measure due to the aerial fertilization effect of rising atmospheric CO₂.

Chapter 4 concludes with an examination of topics pertaining to biodiversity, plant extinctions, and plant evolution, which represent three important topics in assessing the state of Earth's future terrestrial biosphere. The key findings of this chapter are presented in Figure 7.



CO2 is the lynchpin in maintaining biodiversity - it produces key vegetation that helps biodiversity flourish

Steward 2000 [Leighton Steward, geologist, environmentalist, author, and retired energy industry executive, Implication for Agriculture, Plants Need CO2, <http://www.plantsneedco2.org/default.aspx?menuitemid=352>] Pearsall

A CO2-induced increase in vegetative productivity may well be one of the best allies we will ever have in our battle to preserve the planet's biodiversity. In a worldwide study of the vascular plants of 94 terrestrial ecosystems, for example, it was found that ecosystem species richness is more positively correlated with ecosystem productivity than it is with anything else (Scheiner and Rey-Benayas, 1994). In addition, a major review of plant-animal interactions in 51 terrestrial ecosystems has found that the biomass of plant-eating animals or herbivores is also a strongly increasing function of aboveground primary production (McNaughton et al., 1989); while a review of 22 aquatic ecosystems has found that the herbivore biomass of watery habitats increases in response to a rise in underwater vegetative productivity (Cyr and Pace, 1993). In light of these facts, it is likely that Earth's animal life - both terrestrial and aquatic - will experience population responses to rising levels of atmospheric CO2 that will parallel those of the plant kingdom; for the greater the plant food base, the greater the superstructure of animal life that can be supported. And with greater populations of individual organisms, greater biodiversity will likely abound, as each species of plant and animal must maintain a certain "critical biomass" to sustain its unique identity and insure its long-term viability.

When air temperatures and atmospheric CO2 concentrations rise concurrently, there is another CO2-induced phenomenon that also tends to increase ecosystem species richness. Driven by the unique ability of atmospheric CO2 enrichment to increase the ability of plants to withstand higher temperatures, this phenomenon leads to a stabilization of the low-latitude boundaries of the ranges of most plant species, even in the face of significant regional or global warming, while allowing them the opportunity to expand their high-latitude boundaries and thereby increase the sizes of their ranges. Herbivores that feed upon plants, and carnivores that eat herbivores and other animals, then have the opportunity to likewise increase the sizes of their ranges. And the increased overlapping of plant and animal habitats provided by this phenomenon tends to increase ecosystem biodiversity the world over, as is currently being observed in studies specifically designed to explore these phenomena.



Warming makes species less likely to go extinct- increases habitat boundaries

Idso, 2007_Sherwood, former research physicist with the U.S. Department of Agriculture's Agricultural Research Service and former adjunct professor in Geology, Geography, and Botany and Microbiology @ Arizona State U, and Craig Idso, founder of the Center for the Study of Carbon Dioxide and Global Change and former Director of Environmental Science at Peabody Energy, _ "Carbon Dioxide and Global Change: Separating Scientific Fact from Personal Opinion", <http://co2science.org/education/reports/hansen/HansenTestimonyCritique.pdf>, p. 16-7

Switching from plants to animals, Parmesan et al. (1999) examined the distributional changes, broadly spread over the past century, of non-migratory species of butterflies whose northern boundaries were in northern Europe and whose southern boundaries were in southern Europe or northern Africa. Their analysis indicated that the northern boundaries of the ranges of 52 species shifted northward for 65% of them, remained stable for 34% of them, and shifted southward for 2% of them, while the southern boundaries of the ranges of 40 species shifted northward for 22% of them, remained stable for 72% of them, and shifted southward for 5% of them. Consequently, in the words of the thirteen researchers who conducted the work, "nearly all northward shifts involved extensions at the northern boundary with the southern boundary remaining stable."

Since this is precisely the type of behavior we would expect for plants in a CO₂-enriched and warming world - i.e., an opportunity for significant poleward expansion at the cold edge of a species' range, but little to no impetus for poleward migration at the warm edge of its range - it is possible that the observed changes in European butterfly ranges over the past century of concomitant warming and rising atmospheric CO₂ concentration are related to matching changes in the ranges of the plants upon which the butterflies depend for food. Or, the similarity could be due to some more complex phenomenon, possibly even a direct physiological effect of temperature and atmospheric CO₂ concentration at work on the butterflies themselves.

In any event, in the face of the 0.8°C of warming experienced in Europe over the 20th century and the 75-ppm (25%) increase in atmospheric CO₂ concentration experienced concurrently, the ultimate consequence for European butterflies has not been threatening at all, much less a portent of extinction. In fact, since "nearly all northward [range] shifts involved extensions at the northern boundary with the southern boundary remaining stable," according to Parmesan et al., "most species effectively expanded the size of their range when shifting northwards," which likely strengthened them against the possibility of extinction.

Although we have highlighted the findings of just a few real-world studies of the effects of concomitant increases in air temperature and atmospheric CO₂ concentration on the "sustainability" of earth's plant and animal species, many additional studies that have yielded similar results have been described in detail by Idso et al. (2003), whose report on the subject can be found on our website and should be considered a vital appendage of our critique of Hansen's testimony. Consequently - and not wanting to "beat a dead horse" any further in this regard - we proceed to a consideration of a woefully under-reported aspect of the topic that is almost never discussed in the climate-alarmist literature that portrays anthropogenic CO₂ emissions as leading to massive species extinctions. And why does it fail to appear there, as well as in Hansen's testimony? It fails to appear because this aspect of the subject totally undercuts climate-alarmist policy prescriptions for averting their contrived species extinction catastrophe, as well as the many other climate-related disasters described by Hansen.



Increasing CO2 levels make plants more judicious with their water use, solves drought

Walsh 13. Senior writer for TIME magazine, covering energy, the environment and disease; Previously the Tokyo bureau chief for TIME (Brian, "In the Greenhouse: Forests Get More Water Efficient as Carbon Dioxide Levels Rise," Time, 6/11/13, <http://science.time.com/2013/07/11/in-the-greenhouse-forests-get-more-water-efficient-as-carbon-dioxide-levels-rise/>)/ADavid Nature may have its own way of adapting to climate change, as a new study shows that **forests get more economic with water as greenhouse gases levels increase.** The response to climate change has two sides: mitigation and adaptation. Mitigation means reducing greenhouse gases in an effort to slow the pace of warming and lessen its effects. Adaptation means responding to those effects, working to blunt climate change as it unfolds. It's offense versus defense. Mitigation gets most of the attention because it mostly involves changing the way we use energy, something that we spend trillions of dollars on. Such shifts can have a huge impact on the economy—for better and for worse—which is why the political battle over climate policy tends to be so heated. But as extreme weather events like Sandy have given us coming attractions of what life in a warmer world could well be like—insert caveat that you can't directly tie any single weather event to warming—**adaptation has moved up the political agenda.** This is as it should be—whatever the impacts of pumping billions and billions of tons of carbon into the atmosphere turn out to be, we know for sure that a more crowded and richer world is one that will be increasingly vulnerable to all sorts of natural shocks: droughts, floods, storms. It makes sense to prepare. But **human beings aren't the only species that will need to adjust to a changing planet. Plants and wildlife will have to adapt as well—adapt or die. And that's what makes a new paper in Nature on how forests have been responding to increased levels of carbon dioxide so interesting.** Plants absorb CO2 to fuel photosynthesis, opening their stomata to admit the gas, and every time they do they lose water through evaporation. **As CO2 levels rise, forests are able to take in more of the gas and simultaneously reduce the amount of water they need to use to do so, because the stomata don't need to open as wide to take in CO2.** Computer climate models have suggested that as CO2 increases and the world warms, water-use efficiency and plant growth should improve—at least to a point—as an unintentional side benefit of climate change. The American and German researchers who worked on the Nature study wanted to test out those models in the real world. **Using data collected from forests in the northeastern U.S., they found that as carbon concentrations increased by about 5% per decade over the past 20 years, the rates of water-use efficiency increased by about 3% a year.** That's much faster than computer models would have suggested—it means the improvement in water-use efficiency is about six times as large as the corresponding increase in carbon concentrations. As Trevor Keenan of Harvard University, a lead author on the paper, put it in a statement: **This could be considered a beneficial effect of increased atmospheric carbon dioxide. What's surprising is we didn't expect the effect to be this big. A large proportion of the ecosystems in the world are limited by water—they don't have enough water during the year to reach their maximum potential growth. If they become more efficient at using water, they should be able to take more carbon out of the atmosphere due to higher growth rates.** We're hardly off the hook for global warming—as temperatures climb thanks to climate change, crippling heat waves will likely overwhelm the beneficial effects of more carbon dioxide in the air. **But the Nature study shows that even as human beings belatedly begin to prepare for a hotter and more violent planet—and make efforts to mitigate the worst of the damage—nature may have its own adaptation plan.**



Increasing atmospheric CO₂ content makes plants become more efficient with water use—leaf stomata close, preventing evaporation

Karlsruhe Institute of Technology 13. Karlsruhe Institute of Technology (KIT) is a public corporation according to the legislation of the state of Baden-Württemberg. It fulfills the mission of a university and the mission of a national research center of the Helmholtz Association. Research activities focus on energy, the natural and built environment as well as on society and technology and cover the whole range extending from fundamental aspects to application. With about 9400 employees, including more than 6000 staff members in the science and education sector, and 24500 students, KIT is one of the biggest research and education institutions in Europe. Work of KIT is based on the knowledge triangle of research, teaching, and innovation (Karlsruhe Institute of Technology, "Nature: How Forests Cope with more Carbon Dioxide," 11/07/13, https://www.kit.edu/kit/english/pi_2013_13634.php)//ADravid

While carbon dioxide concentration in the atmosphere increases, forests enhance their water use efficiency: They can take up more gas without losing more water. According to long-term measurements at many forest locations in the northern hemisphere, **stomata on leaf surfaces react to more carbon dioxide, which is an example of the strategies of ecosystems to cope with changes.** The study of researchers from the USA and KIT is now reported in the journal "Nature" (DOI: 10.1038/nature12291). In the course of photosynthesis, plants bind carbon dioxide from the atmosphere.

While the carbon dioxide is taken up through the open stomata of their leaves, water vapor is released. The ratio between the transpired water and bound carbon, so-called water use efficiency, is an indicator of the ecosystem's function and plays a key role in the global water, energy, and carbon cycle. For the first time, **a team of scientists,** including the Head of the Atmospheric Environmental Research Division of the KIT Institute of Meteorology and Climate Research (IMK-IFU), Professor Hans Peter Schmid, **has now studied the exchange of water and carbon in the ecosystem by means of long-term field measurements. In cooperation with colleagues from Harvard University, Ohio State University, Indiana University, and the USDA Forest Service, Schmid evaluated measurements of seven forest locations in the Middle West and North East of the USA and compared them with 14 other forest locations** in the northern hemisphere. The forests represent three compositions that are typical of the temperate and cold-temperate zone of the northern hemisphere. No active forest management measures are taken. **Evaluation of the measurements reveals a significant increase in water use efficiency in the past two decades.**

To explain this development, the researchers analyzed various hypotheses. Apart from the increase in the carbon dioxide concentration, **they also considered factors like the increasing availability of nitrogen, changes of the vegetation structure by growth, mechanical and thermal coupling between the crown and the atmosphere, and long-term deviation of measurement systems.** The scientists found that the increased water use efficiency can be attributed to a strong fertilizing effect of carbon dioxide. **When the concentration of carbon dioxide in the atmosphere increases, the trees partly close the stomata on the leaf surface in order to keep the carbon dioxide concentration inside the leaves largely constant. "This shows that forests sensitively react to changes of the environment,"** explains Professor Hans Peter Schmid, who conducts research at KIT's Campus Alpine in Garmisch-Partenkirchen. "Ecosystems have strategies to cope with climate change and to use their resources efficiently."

According to Schmid, **the increase in water use efficiency of the forests exceeds the assumptions made on the basis of theoretical studies and models. As a result of the increased water use efficiency, the plants need less water in spite of an increased photosynthesis on the ecosystem level.** In Schmid's opinion, the results obtained so far from the still ongoing study suggest a shift in the water and carbon budget of the vegetation on Earth. "Probably, the role of stomata on the leaf surface in the interaction between forests and the climate has to be reevaluated and established vegetation-climate models need to be revised." The long-term behavior of ecosystems subject to climate change and the development of appropriate measurement methods are among the central activities of IMK-IFU on KIT's Campus Alpine.



Increased CO2 creates Amazon resilience and offsets warming

Johnson, 2014 - Writer for Weather Underground (Terrell, "Climate Change Catch-22: Could More CO2 Save the Amazon Rainforest?" Weather Underground, 2014, <http://www.wunderground.com/news/could-more-co2-actually-save-amazon-rainforest-20140515/>)/VIVIENNE

To protect human societies from the worst impacts of climate change - like rising seas that inundate coastal cities, extreme weather like 2012's Sandy, and more intense droughts that harm food production and intensify competition for water - most scientists agree: The world must slow and eventually stop pumping greenhouse gases into the atmosphere. So it's counter-intuitive, to say the least, that a team of scientists is planning exactly the opposite in the Amazon rainforest - to intentionally release carbon dioxide, the chief greenhouse gas emitted by humans, in an experiment to determine whether more CO2, not less, will protect forests like it from global warming-related drought. "The simulated models show that the fertilizing effect of CO2 could be crucial in keeping the forest alive," ecology researcher David Lapola, the experiment's lead scientist, told Brazil's Sao Paulo Gazette. "But for now this is still mere speculation. Only such an experiment will give us an answer." Led by Sao Paulo State University in concert with 14 other research centers, the experiment uses a method called FACE - an acronym for "Free-Air Carbon dioxide Enrichment" - to bombard a small, sectioned-off patch of the forest with CO2. A boon for forests? The theory goes like this: because global warming is expected to exacerbate droughts in places like the Amazon basin, the forests there could shrivel up and die on a massive scale if drought conditions persist for much longer periods of time. But higher CO2 concentrations might boost photosynthesis in trees and plants, enabling the forest to withstand climates more severe than today's, and keep its ecosystems alive and intact. The stakes couldn't be higher for places like the Amazon rainforest, which spans some 2.1 million square miles across parts of nine South American countries. As Nature magazine reported in an article last year, "a dying rainforest could release gigatonnes of carbon into the atmosphere, accelerating warming; a CO2-fertilized forest could have the opposite effect, sucking up carbon and putting the brakes on climate change." That's because plants could grow faster in an atmosphere with elevated levels of CO2, and use less water because their stomata - the tiny openings in leaves through which plants breathe in carbon dioxide and expel oxygen - don't have to open for as long. "Less water escapes through transpiration, which makes plants better able to withstand heat and drought," Nature magazine notes. "The net result is that, at least in climate models, the extent of CO2 fertilization largely determines the Amazon's resilience to global warming." To conduct the experiment, the research team plans to encircle a small area of the rainforest with a "gas ring" that expels CO2 at roughly 200 parts per million above the normal atmospheric level, a roughly 50 percent increase over today's average level of 400 ppm. Planned for rollout between 2015 and 2017, the project is set to gather data until about 2027. This will be the first time an experiment like this has been tried in a tropical rainforest. Similar projects have been conducted since the early 1990s in similar forest environments in the Northern Hemisphere. Those experiments have yielded some significant results, showing "an initial fertilization effect" according to Nature. But longer-term responses in those cases varied, depending on the nutrients present in the soil. In theory, the magazine added, "the fertilization effect should be stronger in the tropics, where warmer temperatures work in concert with higher CO2 levels to increase the rate of photosynthesis." However, it also noted this caution: "But plants shut down altogether if the temperature gets too high."



Amazon destruction causes extinction

Takacs 96 - Ph.D. in science and technology studies @ Cornell, Professor of Environmental Humanities, Institute for Earth Systems Science and Policy, California State University, Monterey Bay (David, The Idea of Biodiversity: Philosophies of Paradise, p. 200-1)

"Habitat destruction and conversion are eliminating species at such a frightening pace that extinction of many contemporary species and the systems they live in and support ... may lead to ecological disaster and severe alteration of the evolutionary process," Terry Erwin writes."

And E. O. Wilson notes: "The question I am asked most frequently about the diversity of life: if enough species are extinguished, will the ecosystem collapse, and will the extinction of most other species follow soon afterward? The only answer anyone can give is: possibly. By the time we find out, however, it might be too late. One planet, one experiment." So biodiversity keeps the world running. It has value in and for itself, as well as for us. Raven, Erwin, and Wilson oblige us to think about the value of biodiversity for our own lives. The Ehrlichs' rivet-popper trope makes this same point; by eliminating rivets, we play Russian roulette with global ecology and human futures: "It is likely that destruction of the rich complex of species in the Amazon basin could trigger rapid changes in global climate patterns. Agriculture remains heavily dependent on stable climate, and human beings remain heavily dependent on food. By the end of the century the extinction of perhaps a million species in the Amazon basin could have entrained famines in which a billion human beings perished. And if our species is very unlucky, the famines could lead to a thermonuclear war, which could extinguish civilization." Elsewhere, Ehrlich uses different particulars with no less drama: What then will happen if the current decimation of organic diversity continues? Crop yields will be more difficult to maintain in the face of climatic change, soil erosion, loss of dependable water supplies, decline of pollinators, and ever more serious assaults by pests. Conversion of productive land to wasteland will accelerate; deserts will continue their seemingly inexorable expansion. Air pollution will increase, and local climates will become harsher. Humanity will have to forgo many of the direct economic benefits it might have withdrawn from Earth's well stocked genetic library. It might, for example, miss out on a cure for cancer; but that will make little difference. As ecosystem services falter, mortality from respiratory and epidemic disease, natural disasters, and especially famine will lower life expectancies to the point where cancer (largely a disease of the elderly) will be unimportant. Humanity will bring upon itself consequences depressingly similar to those expected from a nuclear winter. Barring a nuclear conflict, it appears that civilization will disappear some time before the end of the next century not with a bang but a whimper. 14



Warming increases genetic diversity as species adapt to climate change

Singer, distinguished research professor at George Mason and Avery, director of the Center for Global Food Issues at the Hudson Institute, **2007**

(S. Fred, Dennis T, "Unstoppable Global Warming: Every 1,500 Years" Page 12)

We know that species can adapt to abrupt global warming because the climate shifts in the 1,500-year cycle have often been abrupt. Moreover, the world's species have already survived at least six hundred such warmings and coolings in the past million years. The major effect of global warming will be more biodiversity in our forests, as most trees, plants, birds, and animals extend their ranges. This is already happening. Some biologists claim that a further warming of 0.8 degrees Celsius will destroy thousands of species. However, the Earth warmed much more than that during the Holocene Climate Optimum, which occurred 8,000 to 5,000 years ago, and no known species were driven extinct by the temperature increase.



CO2 good for coral, increases photosynthesis

Idso, et al., 2008_Craig, founder and former President of the Center for the Study of Carbon Dioxide and Global Change and former

Director of Environmental Science at Peabody Energy, Sherwood Idso, former Research Physicist with the U.S. Department of Agriculture's Agricultural Research Service and former adjunct professor in the Departments of Geology, Geography, and Botany and Microbiology at Arizona State University, and Keith Idso, adjunct associate in plant biology at Arizona State University, CO2 Science, "Coral Calcification and Photosynthesis in a CO2-Enriched World of the Future", Vol. 11, No. 21, <http://www.co2science.org/articles/V11/N21/EDIT.php>

Many are the people who have predicted that rates of coral calcification, as well as the photosynthetic rates of their symbiotic algae, will dramatically decline in response to what they typically refer to as an acidification of the world's oceans, as the atmosphere's CO2 concentration continues to rise in the years, decades and centuries to come (see Calcification (Corals) in our Subject Index). As ever more pertinent evidence accumulates, however, the true story appears to be just the opposite of what these climate alarmists continue to tell us. A case in point is the recent study of Herfort et al. (2008), who note that an increase in atmospheric CO2 will cause an increase in the abundance of HCO3- (bicarbonate) ions and dissolved CO2, and who report that several studies on marine plants have observed "increased photosynthesis with higher than ambient DIC [dissolved inorganic carbon] concentrations," citing the works of Gao et al. (1993), Weis (1993), Beer and Rehnberg (1997), Marubini and Thake (1998), Mercado et al. (2001, 2003), Herfort et al. (2002) and Zou et al. (2003). To further explore this subject, and to see what it might imply for coral calcification, the three researchers employed a wide range of bicarbonate concentrations "to monitor the kinetics of bicarbonate use in both photosynthesis and calcification in two reef-building corals, Porites porites and Acropora sp." This work revealed that additions of HCO3- to synthetic seawater continued to increase the calcification rate of Porites porites until the bicarbonate concentration exceeded three times that of seawater, while photosynthetic rates of the coral's symbiotic algae were stimulated by HCO3- addition until they became saturated at twice the normal HCO3- concentration of seawater. Similar experiments conducted on Indo-Pacific Acropora sp. showed that calcification and photosynthetic rates in these corals were enhanced to an even greater extent, with calcification continuing to increase above a quadrupling of the HCO3- concentration and photosynthesis saturating at triple the concentration of seawater. In addition, they monitored calcification rates of the Acropora sp. in the dark, and, in their words, "although these were lower than in the light for a given HCO3- concentration, they still increased dramatically with HCO3- addition, showing that calcification in this coral is light stimulated but not light dependent." In discussing the significance of their findings, Herfort et al. suggest, as we have long contended (Idso et al., 2000), that "hermatypic corals incubated in the light achieve high rates of calcification by the synergistic action of photosynthesis [our italics], which, as they have shown, is enhanced by elevated concentrations of HCO3- ions that come courtesy of the ongoing rise in the air's CO2 content. As for the real-world implications of their work, the three researchers note that over the next century the predicted increase in atmospheric CO2 concentration "will result in about a 15% increase in oceanic HCO3-," and they say that this development "could stimulate photosynthesis and calcification in a wide variety of hermatypic corals." This well-supported conclusion stands in stark contrast to the outworn contention of the world's climate alarmists that continued increases in the air's CO2 content will, as restated by Herfort et al., "cause a reduction in coral growth and planktonic calcification." This claim, as they and many others have now demonstrated, is about as far from the truth as it could possibly be.



Increasing CO₂ output increases food production to feed growing population - will not require more land or water

Idso et al 2011 [Craig D. Ph.D Chairman for the Center for the Study of Carbon Dioxide and Global Change, Climate Change Reconsidered 2011 Interim Report” Nongovernmental International Panel on Climate Change, <http://nippcreport.org/reports/2011/pdf/2011NIPCCinterimreport.pdf>] pearson

Rising temperatures and atmospheric CO₂ concentrations, by increasing crop yields, will play a major role in averting hunger without the taking of new land and water from nature. For a nominal doubling of the air’s CO₂ concentration, for example, the productivity of Earth’s herbaceous plants rises by 30 to 50 percent and the productivity of its woody plants rises by 50 to 80 percent or more. In addition, atmospheric CO₂ enrichment typically increases plant nutrient and water use efficiency.



Food shortages causes terrorism and drugs—Failed states

Brown, 9 [Lester, founder and president of the Earth Policy Institute, “Could food shortages Bring down civilization”, http://www.earthpolicy.org/images/uploads/press_room/SciAm-final.pdf] zabner

Even a cursory look at the vital signs of our current world lends unwelcome support to my conclusion. And those of us in the environmental field are well into our third decade of charting trends of environmental decline without seeing any significant effort to reverse a single one. In six of the past nine years world grain production has fallen short of consumption, forcing a steady drawdown in stocks. When the 2008 harvest began, world carryover stocks of grain (the amount in the bin when the new harvest begins) were at 62 days of consumption, a near record low. In response, world grain prices in the spring and summer of last year climbed to the highest level ever. As demand for food rises faster than supplies are growing, the resulting food-price inflation puts severe stress on the governments of countries already teetering on the edge of chaos. Unable to buy grain or grow their own, hungry people take to the streets. Indeed, even before the steep climb in grain prices in 2008, the number of failing states was expanding. Many of their problems stem from a failure to slow the growth of their populations. But if the food situation continues to deteriorate, entire nations will break down at an ever increasing rate. We have entered a new era in geopolitics. In the 20th century the main threat to international security was superpower conflict; today it is failing states. It is not the concentration of power, but its absence that puts us at risk. States fail when national governments can no longer provide personal security, food security, and basic social services such as education and health care. They often lose control of part or all of their territory. When governments lose their monopoly on power, law and order begin to disintegrate. After a point, countries can become so dangerous that food relief workers are no longer safe and their programs are halted; in Somalia and Afghanistan, deterioration conditions have already put such programs in jeopardy. Failing states are of international concern because they are a source of terrorists, drugs, weapons and refugees, threatening political stability everywhere.